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The Sanitarian's Place in Public Health*

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THE sanitarian can profit greatly from development of a sense of history; for this promotes perspective, clarifies foresight, induces patience, and brings encouragement. Much of my talk will be deliberately concerned with providing stimuli to this historical sense.

We need not look back too far. Let us start with a quick glance at say 400 years ago. In 1547, Europe's complexion was still suffused with the Renaissance outlook on Art and Science. Just under thirty years before, in 1519, Leonardo da Vinci had died in a castle in central France, where the old sage had spent his declining years under the patronage of the young King Francis I. History tells of no man having more brilliant diversity of talent and interest than Leonardo, who epitomizes his time at its best. His genius would have left its mark upon any century. In art a perfectionist, in science a pioneer, his accomplishments ranged prodigiously from the "Last Supper" and "La Giaconda", to a flying-machine and a system of drainage canals through the Lombardy marshes to improve the crops and reduce the plague.

Four years after Leonardo's death, his patron, the clever and ambitious Francis I, dispatched Juan Verrazano from Dieppe on a voyage of westward exploration, in an attempt to rival the discoveries of Columbus—whose patron, Charles V of Spain, had defeated Francis' efforts to become Holy Roman

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Emperor and leader of Europe. After a rough passage of seven weeks, Verrazano in the "Dauphine" sighted the shore of what is now North Carolina. He sailed northward, following the coasts of Nova Scotia and Newfoundland almost as far as the Straits of Belle Isle, before turning eastward for home.

Eleven years later, Jacques Cartier, a master pilot sworn to the service of Francis, was commissioned by his master to see whether the stormy headlands of Belle Isle might prove the gateway to the empires of the East. On April 20, 1534, Cartier set sail from St. Malo on the first of three voyages to the New Land. On this voyage he could go no farther than Anticosti Island, but from its westernmost point he glimpsed the great waterway which was to lead him later not to the Far East but to the founding of Canada. Cartier's second voyage took him up the Saint Lawrence River as far as the settlement of Hochelaga, where, with a few of his men, he was received on an early October day in 1535, by Agouhanna, lord and king of the Indian tribe who lived there.

Now Agouhanna, according to one of the officers present, "was full of the palsy and his members shrunk together . . . he showed his legs and arms to our captain, and with signs desired him to touch them, and so he did, rubbing them with his own hands. . . They brought before him divers diseased men, some blind, some crippled, some lame, and some so old that the hair of their eyelids came down and covered their cheeks, and laid them all along before our captain to the end that they might of him be touched. For it seemed unto them that God was descended and come down from heaven to heal them. . ." The Old World was later to introduce plenty of its own plagues to the New, but we need not lay all the red man's ills at the white man's door.

In 1530, between the voyages to North America of Verrazano and Cartier, a countryman of Leonardo's, Girolamo Fracastor of Verona, had published the poem "Syphilis sive morbus Gallicus", describing the ravages of the disease wherewith in anger Apollo had smitten the swineherd Syphilus. Libellously termed "the French disease", it was not the soldiers of the King of France, but rather the sailors of Columbus, hireling of his enemy, Charles V of Spain, who probably initiated the epidemic of syphilis which had swept over Europe, as is its wont, in the wake of war, afflicting swineherd and monarch alike. Henry VIII of England died of syphilis and many dissipations exactly 400 years ago. One year before, Fracastor had deduced, in a second notable treatise, "De Contagione", many of the modes of transmission of communicable diseases, whose agents he had prophetically termed "minute reproductive germs."

Let us move on a century, to 1647. Another great Italian, Galileo, who had brought far things near to us, and had suffered at the hands of the Inquisition for proclaiming that the earth was not the centre of the universe, had died five years before. In England, William Harvey was rounding out his famous work on the circulation of the blood. Charles I had less than two years left of his unhappy reign, before being decapitated in the name of the people's religious and political rights. During his reign, and that of his dissolute son, countless hundreds of thousands of their subjects were deprived of the right to live by smallpox and the Black Death.

In these words, the diarist John Evelyn recollected travelling as a five-year-old child from London to Lewes in 1625.

"This was the year in which the pestilence was so epidemicall that there dy'd in London 5000 a week; and I well remember the strict watches and examinations upon the ways as we passed."

(The watchmen at the gates of towns served as sanitarians in those times.) Again, in 1636, he wrote:

"This yeare being extreamely dry, the pestilence much increased in London and divers of England."

Evelyn himself escaped the plague, but ten years later caught smallpox at the end of a long day's journey in Switzerland, in circumstances told thus:

"Being extreamly weary and complaining of my head, and finding little accommodation in the house, I caus'd one of our hostesses daughters to be removed out of her bed and went immediately into it whilst it was yet warme, being so heavy with pain and drowsinesse that I would not stay to have the sheetes chang'd; but I shortly after payd dearly for my impatience, falling sick of the small pox so soon as I came to Geneva, for by the smell of frankincense and the tale the good woman told me of her daughter having had an ague, I afterwards concluded she had been newly recover'd of the small pox."

Having been bled, purged, and submitted to leaches by a former physician of Gustavus, King of Sweden, Evelyn reported:

"They now kept me warme in bed for 16 daies, tended by a vigilant Swiss matron, whose monstrous throat, when I sometimes awak'd out of unquiet slumbers, would affright me. After the pimples were come forth, which were not many, I had much ease as to paine, but infinitely afflicted with the heat and noysomenesse. By God's mercy after five weeks keeping my chamber I went abroad. . ."

These excerpts give a vivid glimpse of the level of hygiene and the therapeutic nostrums of 300 years ago. Cures were indeed dependent upon God's mercy. And since the King was still looked upon by many as the agent of the Lord, his touch might heal. So in 1660, Evelyn tells us, he travelled to the Guildhall in the City of London, to see "His Majestie . . . touch for the evil." It is not clear why scrofula, or tuberculous cervical adenitis, should have been especially benefitted by the King's touch. But faith in vainglory dies hard; and despite the Mumbo-Jumbo of those times, there was a great fresh wind sweeping overhead, heralding now not the rebirth of learning, but the enthronement of experimental science.

Two years later, in 1662, Evelyn refers to the incorporation, "under the broad seale", of the Royal Society—of which he, like Pepys, was a Fellow—"for the improvement of natural knowledge by experiment." It was to this Society (which had existed clandestinely as "The Invisible College" for some years prior to receiving its Royal charter from Charles II) that Anton van Leeuwenhoek began sending, from the Netherlands, a decade later, a stream of letters describing the cavortings of those "little beasties" which his primitive microscopes had revealed to his own and his neighbours' astonished eyes. But a long while had to pass before the work of such great observers was translated into effective principles of control against smallpox, or against syphilis, the great pox; or against plague and scrofula. And long enough will still elapse before the people realize they must play their part to secure freedom from these and other preventable diseases, and from premature death.

The members of the Royal Society, like everyone else in London, were soon at wit's end to avoid the Great Plague of 1665. On July 16, Evelyn records:

"There died of the plague in London this weeke 1100, and in the weeke following above 2000." On August 2: "A solemn fast thro' England to deprecate God's displeasure against the land by pestilence and war; our Dr. preaching . . . that the meanes to obtaine remission of punishment was not to repine at it, but humbly submit to it." On August 8: "Died this week in London 4000." August 15: "There perished this week 5000." August 28: "The contagion still increasing and growing now all about us, I sent my wife and whole family (two or three necessary servants excepted) to my brother's at Wotton, being resolved to stay at my house myselfe . . . trusting in the providence and goodnesse of God." September 7: "Came home, there perishing neere 10,000 poore creatures weekly; however I went all along the Citty and suburbs from Kent Streete to St. James', a dismal passage, and dangerous to see so many coffines expos'd in the streets, now thin of people; the shops shut up, and all in mourneful silence, as not knowing whose turn might be next."

Pepys, whose impressions were similar, wrote in his Diary for June 7, 1665:

"The hottest day that ever I felt in my life. This day, much against my will, I did in Drury Lane see two or three houses marked with a red cross upon the doors, and "Lord have mercy upon us", writ there; which was a sad sight to me, being the first of the kind that to my remembrance I ever saw." On August 22: "I went away and walked to Greenwich, in my way seeing a coffin with a dead body therein, dead of the plague, lying in an open close belonging to Coome farm, which was carried out last night, and the parish have not appointed anybody to bury it; but only set a watch there all day and night, that nobody should go thither or come thence: this disease making us more cruel to one another than we are to dogs." August 30: "I went forth and walked towards Moorefields to see (God forgive my presumption!) whether I could see any dead corpse going to the grave; but, as God would have it, did not. But Lord! how everybody looks, and discourse in the streets is of death, and nothing else, and few people going up and down, that the town is like a place distressed and forsaken." September 3: "(Lord's day) Up; and put on my coloured silk suit very fine, and my new periwigg, bought a good while since, but durst not wear, because the plague was in Westminster when I bought it; and it is a wonder what will be the fashion after the plague is done, as to periwiggs, for nobody will dare to buy any haire, for fear of the infection, that it had been cut off the heads of people dead of the plague. . ."

One last quotation must suffice. It suggests that the body, dead of the plague, which Pepys saw in a coffin thirteen days before, had left a tragic legacy, despite the watch:

"Sept. 4 Walked home, my Lord Brouncker giving me a very neat cane to walk with; but it troubled me to pass by Coome farm where about twenty-one people have died of the plague."

Meanwhile, in 1617, three years before John Evelyn was born, Louis Hébert, an apothecary from Paris, had cleared the first ten acres of land in New France, and built a stone house for his family and himself on the heights above Quebec. Newcomers arrived from France in very small numbers, and from the beginning, the settlers were ravaged by smallpox, typhus fever, and cholera. Indeed, it is remarkable that the colony ever survived the decimations of its population by pestilences brought to the shores of Canada so frequently by immigrants; for it was not until 1721 that the first quarantine regulations were imposed, requiring all ships to anchor in the St. Lawrence, and to fire three cannon or musket shots a quarter of an hour apart, as warning that crews and passengers needed inspection.

Yet in many respects, public health legislation was ahead of the times. By 1678, ten years after the Great Plague in London had been stopped by the Great

Fire, a law requiring the compulsory registration of births, marriages and deaths was passed in Quebec. These statistics, faithfully kept ever since by the curés, are amazingly complete. Again, regulations governing the sale of safe meat were introduced into the young colony as early as 1707. But there were no professional statisticians or sanitarians to give effect to public health enactments in those days. The law, the Church and the militia supervised such things. Before an animal could be slaughtered for sale as meat, it had to be certified free from disease by a "judge, seigneur, curé, or military officer."

To reach a point from which sanitary science, as we know it today, can be seen taking shape, it is necessary to move forward two centuries. To this young, underpeopled country, the recurrent visitations by epidemics, which quarantine regulations had done little to stem, were major disasters; so that at last, in the year 1847, when over 20,000 immigrants to the Canadas died of typhus fever alone, some 75 Boards of Health were established to cope with the situation—only to be disbanded as soon as the emergency was over. No permanent sanitary precautions were enforced, and proper isolation was not attempted, all cases being nursed in general hospitals. Indeed, 20 years later, at the time of Confederation, "public health" was so dim a conception that no reference was made to it in the British North America Act—an omission from which many sad consequences still derive.

Meanwhile, the Old Country was in the throes of the Industrial Revolution. A blight fell upon much of England's green and pleasant land, as masses of people left the fields to crowd into the workshops, and apprenticed their children in 'these dark Satanic Mills'. The migrations, and the rapid expansion in population which followed, brought in their wake all the evils, filth and pollutions of slum life; and since the towns lacked the simplest essentials of community sanitation, water borne epidemics of cholera, typhoid fever and dysentery were inevitable.

Social reformers goaded parliamentarians to pass a series of "Factory Acts", and to appoint a succession of Royal Commissions on drainage and sanitation. The Secretary to the Poor Law Board, Edwin Chadwick, an energetic idealist, produced in 1842 his classic Report on the Sanitary Conditions of the Labouring Population of Great Britian. He had already largely converted the Poor Law Commissioners to the doctrine that sickness and ill-health were the fundamental causes of pauperism—a relationship which 100 years later the American Medical Association was maintaining should be reversed. Chadwick's report paints in lurid detail a picture of sanitation a century ago. His investigators found putrefying refuse thrown in front of houses and blocking the unpaved streets. Dogs and pigs were the only scavengers. Houses swarmed with vermin, and their doors opened into uncovered cesspools, which it was nobody's duty to clean out. Privies were so laden with excrement as to be unusable. In the overcrowded workshops, the heat was suffocating, and the windows always sealed. Gin was brought in at frequent intervals throughout the day. Consumption was rampant and intemperance rife. Meanwhile, wrote Chadwick: "The Civic Officers sat still amidst the pollution with the resignation of Turkish fatalists."

The people of London were never free from the threat of water-borne epidemics. Lord Woolton, war-time Minister of Food, in his Presidential Address to a recent Health Congress, quotes the following extract from the Edinburgh Review of April, 1850, which indicates that in some parts of Great Britain at least, the sanitation of the capital city was not viewed with pride:

"The refuse and dirt from two million individuals—the enormous accumulation of waste and dead animal and vegetable matter—the blood and offal of slaughter-houses—the outpourings from gasworks, dyeworks, breweries, distilleries, glue-works, bone-works, tanneries, chemical and other works—and a thousand nameless pollutions—all find their way into the Thames. The mixture is then washed backwards and forwards by the tide, and having been thoroughly stirred up and finely comminuted by the unceasing splash of 298 steamboats, is then pumped up for the use of the wealthiest city in the world!"

Chadwick's report had immense value as an awakener of the nation's sanitary conscience, and undoubtedly led (after the customary delays) to the passing of the first Public Health Act, in 1848, which authorized the appointment of Medical Officers of Health, and also of sanitarians, under the guise of inspectors of nuisances. This Act was the precursor to similar legislation elsewhere in the Old World and the New. The Public Health Acts of the Canadian Provinces followed closely upon passage of the 1875 Public Health Act in Great Britain. By then, Chadwick had been dethroned, on the grounds that he was arrogant and autocratic. The "Times" wrote in 1854: "Aesculapius . . . in the form of Mr. Chadwick [has] been deposed, and we prefer to take our chance of cholera and the rest than be bullied into health . . . England wants to be clean, but not to be cleaned by Chadwick. . ." Ninety years after the above diatribe in the "Times", a columnist in a Vancouver newspaper, after a probably libellous stint about fascist-minded experts, delivered himself—in the name of democracy!—of this prize sample of petty paradoxy regarding the city's water supply, which had been recently chlorinated: "I can't say I have noticed any taste in or suffered any ill effects from the medicated solution we are afflicted with. Nevertheless I am utterly and completely and finally opposed to chlorination, and ever shall be—not because it is bad for us, but because it is good for us. . ."

In the year of Chadwick's deposition, Dr. John Snow finally proved, by a classic piece of epidemiological detective work, that cholera outbreaks could be water-borne. In 1849, there had been over 53,000 cholera deaths in England alone; and the serious outbreaks which occurred in London in 1853-54 afforded Snow the opportunity of verifying the theory which his observations over several years had led him to develop. With the true scientist's zeal and scepticism, he wrote:

"I had no reason to doubt the correctness of the conclusions I had drawn from the great number of facts in my possession, but I felt that the circumstances of the cholera-poison passing down the sewers into a great river, and being distributed through miles of pipes, and yet producing its specific effects, was a fact of so startling a nature, and of so vast importance to the community, that it could not be too rigidly examined, or established on too firm a basis."

In the same class as Snow's monograph on cholera was Dr. William Budd's work on typhoid fever. Budd's theory that typhoid fever was due to a specific

poison, seed, or germ present in the excreta of typhoid patients, rather than to the effluvia from decomposing sewage, dated back to a paper by him in the "Lancet" in 1857, just two years after the publication of Snow's work, at which time 15,000 persons were dying annually of typhoid fever in Great Britain. Publishing his observations in book form in 1873, Budd overthrew the 'pythogenic' theory (that typhoid fever was born in putrescence), and established an extrinsic, pathogenic agent as the cause of the disease. An important link in Budd's argument was the fact that "during the hot months of 1858 and 1859, when the Thames stank so badly", there was "a remarkable diminution in the prevalence of fever, diarrhoea, and the other forms of disease commonly ascribed to putrid emanations."

Budd conveys in words of unforgettable vividness the intolerable odours then pervading the centre of London:

> "For the first time in the history of man, the sewage of nearly three millions of people had been brought to seethe and ferment under a burning sun, in one vast open *cloaca* lying in their midst. The result we all know. Stench so foul, we may well believe, had never before ascended to pollute this lower air. Never before at least, had a stink risen to the height of an historic event. Even ancient fable failed to furnish figures adequate to convey a conception of its thrice Augean foulness. For many weeks, the atmosphere of Parliamentary Committee-rooms was only rendered barely tolerable by the suspension before every window of blinds saturated with chloride of lime, and by the lavish use of this and other disinfectants. More than once, in spite of similar precautions, the law-courts were suddenly broken up by an insupportable invasion of the noxious vapour. The river steamers lost their accustomed traffic, and travellers, pressed for time, often made a circuit of many miles rather than cross one of the city bridges. For months together, the topic almost monopolised the public prints. Day after day, week after week, the 'Times' teemed with letters, filled with complaint, prophetic of calamity, or suggesting remedies. Here and there, a more than commonly passionate appeal showed how intensely the evil was felt by those who were condemned to dwell on the Stygian banks. At home and abroad, the state of the chief river was felt to be a national reproach. 'India is in revolt, and the Thames stinks', were the two great facts coupled together by a distinguished foreign writer, to mark the climax of a national humiliation. But more significant still of the magnitude of the nuisance was the fact that five millions of money were cheerfully voted by a heavily taxed community to provide the means for its abatement. With the popular views as to the connection between epidemic disease and putrescent gases, this state of things naturally gave rise to the worst forebodings. Members of Parliament and noble lords, dabblers in sanitary science, vied with professional sanitarians in predicting pestilence. If London should happily be spared the cholera, decimation by fever was, at least, a certainty. . ."

Nearly twenty years after this furore of disgust within the Empire's capital, a small-scale echo of it was sounded at the capital of an outpost territory. The following item, which appeared under the heading "Sanitary" in the "Daily British Colonist", published in Victoria on September 29, 1876, has some amusing aspects: "A fearful stench is caused in the vicinity of Hearld and Government Streets by the burning of an accumulation of rags, dead dogs, cats and all manner of rubbish. The residents in that vicinity have complained frequently of the nuisance, but it is allowed to continue in spite of remonstrances. The attention of the proper authorities is therefore again called to the matter." The proper authorities no doubt remained undetermined; for sanitary regulations were not passed in this Province until 1892, when the first Provincial

Health Officer was appointed. In the following year, the Provincial Police were designated sanitary inspectors.

Hard on the heels of Snow and Budd, pioneer epidemiologists, came the era of bacteriology and immunology—of Pasteur and Koch, with their disciples, who by uncovering the nature, habits and habitats of the microbic agents of disease, furnished the key to their control. A remarkable chapter in man's mastery of his environment had opened. Hitherto, fear of pestilence, and anxiety to avoid the costs of caring for the sick poor, had been the main motives for sanitary reform; and the sanitarian was mainly an investigator and eliminator of obvious nuisances, displaying his zeal at its highest pitch after an epidemic had started. Henceforward, to reach his proper stature, he would have to be a detector of potential health hazards, and a public health educator in the most direct, and yet broadest sense. There is undeniably more than enough still to be done under both headings; and in an urbanized civilization which on the whole regards adherence to principle as less important than the struggle for favour and prosperity, one need not quibble over the finer distinctions of objectives, when the means of achieving them are limited. Let me give you a few local examples of what remains to be accomplished in the field of elementary sanitation. I have no wish to make invidious comparisons, but simply to drive home points by reference to tales we all know. Besides, we do our communities a disservice by allegiance to flattery before truth, or by proclaiming an excellent crop when in fact there has been a drought, too many parasites, and a poor harvest.

Consider the Great Plague, and the role of the rat therein. Everybody knows this relationship, while many citizens have heard of sylvatic plague being detected in rodents of the Province and the States contiguous to British Columbia. Yet when a foolhardy soul complained five or six years ago about the City Dump as the main breeding place for myriads of rats infesting Vancouver, the mayor and aldermen rose in defence of the rats, publicly accusing their detractor of being a 'publicity seeker', an 'exhibitionist', a 'knocker', and a 'spoiler of the tourist traffic'. Our dump, it was alleged, was the finest in North America. Expeditions of journalists, students, and finally candidates for political office, began to be organized. The City Dump became a *cause célèbre*—from which interest was diverted only by the advent of Pearl Harbour. . . Things are a little better there now. But rats may still be seen high-tailing from the dump towards a nearby meat-packing plant, while others foot-loose it to the suburbs; and the house-holders' garbage cans are blamed for trouble initiated by the city's own rat-breeding emporium.

I will allude only briefly to the question of milk control, for after many extraordinary obstructions, sale of raw milk has been banned in Vancouver for several months now. In fact citizens can buy, if they wish, pasteurized cream, butter, cheese, whey, beer, wine, honey and face powder. Unhappily, outside this city, the situation is quite different. In almost every community of the Province at large, some unsafe milk is being sold, and in certain areas, safe milk cannot be purchased. This situation should not be tolerated, and I can see little

point in pussyfooting with the sort of viewpoint expressed in the Victoria "Daily Colonist" about two years ago. In an editorial repudiating pasteurization, this astonishing statement appeared: "Life seldom goes by theory but by fact. If all milk should be boiled, the boiler no doubt would have been installed in the cow by Providence. What we are really waiting for is the campaign for antiseptic kisses. That should be a honey!" Well, who knows? Irradiated lipstick is here already. . .

This pasteurization issue has been unnecessarily prolonged because of confusion in the public mind between the *quality* and *safety* of milk. The layman tends to be more concerned about absence of visible dirt, and presence of abundant cream, than about the types and numbers of living microbes in the milk. The veterinarian, with a natural interest in fine barns and vigorous herds, has at times contributed to this confusion. I deplore, with you, the fact that poor quality milk may find its way to pasteurizing plants, and be ineffectively treated there. Many more sanitarians are needed, not only to check pasteurizing equipment, and to collect samples for laboratory tests, but also to inspect the circumstances in which milk is produced on the farm. They should work together with the veterinarian to ensure that milk with bacterial counts of 1-2 million organisms or more per cc. does not find its way into the pool for pasteurization; and indeed should strive to effect a lowering of the unduly high count of half a million now allowed by law. However, from the public health standpoint, the inescapable principle is that raw milk containing only fifty typhoid bacilli per cc. would be dangerous, while milk with a bacterial count however high before treatment becomes safe when properly pasteurized.

My views on the question of chlorinating municipal water supplies are, I suspect, familiar enough to you. I shall not review, before this audience, the ludicrous chronicle of the long-drawn feud over the water supply of Greater Vancouver, especially since, for the time being at least, victory has partially reverted to Hygeia. But lest you were tempted, earlier this evening, to feel elation at the splendid progress made since Chadwick's day, may I just remind you of some of the headlines: "Even the Sea Gulls Know Better"; "Salmonbellies Lose Again - Pure Water Rushed East"; "Mass Meeting Backs Stand against Chlorination - Single Supporter Shouted Down"; "Politicians Waging Secret Chlorine Drive"; "Doped Water Never Was Justified"; "Pure Water and the Parish Pump"; "Down with the Experts". . . Then there were the stray poets, and thousands writing letters to newspaper editors. There was the sonnet entitled "The Rape of Capilano", and another which began:

> "Pasteur, thou shoulds't be living at this hour,
> Vancouver hath need of thee: she is a city
> Of polluted water. . . ."

Chlorine was blamed for all kinds of stomach complaint, for spots, for arthritis, for liver trouble, kidney trouble—everything but brain trouble. It was solemnly averred that the birds were leaving Vancouver, that one man's cows had dried up, and another's wife was barren, because of chlorinated water. Because I expressed myself emphatically on the unpopular side in this contro-

versy, I received an interesting collection of anonymous letters, addressed e.g. "Bugologist", or "Water Wizard". One man enclosed a clipping headed "Pasteur's Germ Theory Mythical", from a recent issue of "The Boomerang"—a small periodical originating somewhere in Australia.

Others were content to insinuate publicly that one was financially interested in chlorinating or dechlorinating apparatus, or was the agent of logging companies, or a large shareholder in a base metal proposition with claims staked in the North Shore mountains; or in some dark way was conspiring to have the P.G.E. Railway brought into Vancouver through the watershed. And when accusations of venality failed to stick, a newspaper claiming devotion to progress and democracy could do no better than publish an editorial praising the "plain citizens, who knew all along by instinct . . . of the pristine purity, untreated safety and general excellence of Vancouver's water supply." One of the major purposes of sanitary science has surely been to protect plain citizens from the dangers to which they may expose themselves and their neighbours if they merely follow 'instinct'! Subsequently another kind of accusation appeared in the editorial column: "He is the man who dropped the germ of doubt about the water's purity which led to its compulsory chlorination in wartime. He is the man who, ever since, has sought to culture the germ into an epidemic of fear of such proportions as to panic the people into a blind obedience to his will." Surely only a very strange community could mistake appeals to its intelligence for dictatorial promptings.

Lastly, a few comments on the problem of sanitation in public eating-places. One of the criticisms levelled by some more thoughtful citizens against the campaign for chlorinated water, was the 'unfairness' of picking on a water supply which was at least relatively safe, while doing nothing about the glaringly obvious hazards from insanitary practices in restaurants and beer parlours. Now it cannot be denied that the risk of infection to an individual who feeds in a public eating-place may be greater than the chances taken by a community drinking unchlorinated water from a mountain lake. But though the odds in the latter instance may be long, the premium required to ensure safety is negligible. A chlorinated water supply will add perhaps a dime each year to our water bills—a small fraction of the sum we are compelled to pay annually to have our automobiles officially tested. Restaurant sanitation, on the other hand, is by comparison far more difficult and costly to secure. There is no foolproof method of ensuring sterile glassware, dishes and utensils, clean hands, and properly selected and prepared foodstuffs. Improved hygienic standards in restaurants and beer parlours must await an aroused and articulate public opinion, which rejects dirty glasses, cracked crockery, unclean linen, finger-printed butter pats, slovenly waitresses, and all such insults to its aesthetic and sanitary conscience. Improvements depend too upon there being a far more adequate staff of sanitarians, armed with the right to inspect what goes on behind the scenes in the kitchen, and with the requisite knowledge and enthusiasm to exercise this right for the benefit of patrons. The closest possible co-operation should also be fostered between the sanitarian and the public health laboratory.

A city of over 400,000 persons, and covering 44 square miles, needs to employ many more than five inspectors in its general sanitation and food division. This is the same number as thirty-five years ago, when the city limits encompassed less than one-third the present territory, and there were fewer hazards to check. In 1912, neither salmonellosis nor staphylococcal food poisoning was recognized, whereas their comparatively high incidence is now well known. Then, 'ptomaines' were held to account for most of the acute food poisoning outbreaks, whereas now ptomaine poisoning is a discarded conception. Food unfit to eat was then expected to be off-flavour, if not decomposing. Now we know that bacterial infection or intoxication can be conveyed by a comestible unaltered in appearance, smell or taste. In those days, only sick persons were regarded as likely sources of infection. Nowadays, public health laboratories have revealed the epidemiological importance of the healthy carrier.

Examples of our community delinquencies in sanitation could be readily multiplied. The spreading blight of our slum areas, the outrageous sewage pollution of our beaches, the high percentage of the city's area unserved by sewers, the poor construction of numerous septic tanks, the exuberant dumping of refuse on vacant lots, the inadequate curbing of dogs, the prevalence of pigeons of uncertified health, the inefficient ventilation of many hotels, workshops and public meeting places, the pall of smoke overhead,—these are only some of the ways in which local public health practice lags far behind precept, and fails to emulate the best examples set elsewhere. Thus we disgrace a setting of unmatched splendour by a blunted civic conscience.

This country is now spared those great decimators—plague, smallpox, cholera and typhus fever—while typhoid fever, diphtheria and tuberculosis are of very diminished incidence. Nevertheless, through ignorance, folly, apathy or bigotry we still expose ourselves, and submit our neighbours, to a needless variety of health hazards. We are now reaping, ungratefully enough, a wonderful harvest from the seed sown by the pioneers of earlier centuries. There has been a doubling of the average life span since the time of Evelyn and Pepys; while two decades have been added since Chadwick, Snow and Budd, over ten of these years accruing since the first World War began. But we can, and should, go further. The knowledge is at hand for securing freedom from practically all the communicable diseases: what is lacking is the wherewithal to ensure its application. Despite the necessity and inevitableness of further research in the sciences bearing upon sanitation, what is now most needed is a scrupulous, enlightened citizenry, democratic (or Christian) enough to be as concerned for their neighbour's health as for their own; and eager to take an honest pride in belonging to a city which need no longer *pretend* to be up-to-date in the appurtenances of civilization.

As trained intermediaries, your part in this dissemination of knowledge is exceedingly important. May your numbers increase, your background of experience and understanding continually enlarge, and your courage never falter!

The Health Officer and the Worker's Health

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THE war from which the Allies have so recently emerged victorious provided a stimulus to work out, through stern necessity, values, methods, materials and standards that permitted us to reach undreamed of production in materials and of the armed forces that were instrumental in the victorious outcome.

We speculate with some misgivings upon what atomic fission has in store, speak nonchalantly of million-volt X-ray equipment, and discuss the uses to which radar and supersonic researches may be utilized in industry. It has been tremendously stimulating and enlightening to live and work in this period of great activity, but a bit too strenuous for a steady diet. We are not to be blamed if we have a tendency to let up and slack off a bit. We must realize, however, that our economy and the world's needs depend on our maintaining, in large measure, this high production level we attained in the period of the war.

The means by which the increased production of materials was attained were many and complex. One of the most important of them was the provision of sufficient manpower on our home front, of new processes, and of new materials. Short-cuts to new methods were useless without manpower to translate them into increased production. We opened up tremendous new pools of manpower by utilizing the physically handicapped individuals by means of careful job analysis, physical examinations, medical consultations and proper placement and follow-up. We secured additional thousands of workers for industry through well-designed rehabilitation programs, reduced labour turnover and absenteeism, improved the health of the workers and increased production in those industries where adequate health services were provided.

To this tremendous task of the full utilization of all our available manpower many agencies have contributed: industry, labor, the medical fraternity, public health agencies, and many official and non-official organizations.

While it is true that a number of the methods by which we obtained all-out production for the war were dictated by expediency, such as very long hours of work, and the employment of women needed in the home, there are many of them which constitute sound procedures which must continue to be utilized and developed if we are to keep the high level of production our country and the world so urgently needs. One of the most important of these is the utilization and preservation of our available manpower through the application of industrial hygiene procedures to this problem.

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Industrial hygiene embraces those factors, and utilizes the work of those agencies concerned with the improvement and maintenance of health and the prevention of disease among our working population. It is inextricably associated with medicine, and reflected in the facets of many allied sciences.

The utilization of industrial hygiene techniques which we as health officers can put into effect will affect the health of millions of our countrymen gainfully employed. Its full development challenges the best in us.

Much has been said and written recently respecting the lack of medical care provided for many of our people; whether it shall remain as it is; whether it should become a government monoply, or whether it should be formulated upon a basis of volunteer or compulsory insurance. We are challenged by the percentage of individuals who were rejected by the armed services and by those who assert that they do not receive the care which medical science can now provide. The root of these questions is concerned basically with the health of our people; and whatever the answers may be to these serious queries, let us keep before us that we as health officers already have in our hands, through the proper application of industrial hygiene and all that it connotes, an opportunity to prevent disease and improve the health among the vast group of our working population, to which we and the medical fraternity can contribute with profit and service to ourselves, industry and the worker.

What should an industrial hygiene program, such as I have mentioned, embrace? It should include:

A. The control of conditions affecting health in the working environment should include the following:
   1. A survey of industrial plants and processes to determine where potential health hazards exist.
   2. Technical studies of potential health hazards when necessary to determine the extent of the hazard.
   3. Recommendations and follow-up for control of any health hazards found in the working environment.
   4. Reports of occupational diseases and investigation of those cases reported.
   5. Epidemiological study of conditions affecting health in industry.
   6. Consultation service to industry, labor and the medical fraternity respecting the effect and control of materials and processes in industry affecting health.

B. Prevention of disease and improvement of the general health of the worker for those conditions not resulting from working environment by:
   1. Bringing to the industrial worker, through industry and labor, public health procedures, such as the mass X-ray, serological examinations, information on nutrition, cancer, venereal disease, maternal and child health, dental hygiene, etc.
   2. Stimulation of better medical service in industry by a survey of plant medical facilities already provided, evaluating their adequacy and suggesting improvement.

If we are to continue to utilize our manpower to its fullest extent to obtain the greatest benefit for industry and the worker, we must stimulate provision of adequate industrial health service, which proved such a potent factor in our all-out production during the war.

A healthy worker is a happier, more dependable, better-paid worker. A good health program in industry pays real dividends. It will improve the health and morale of the worker, reduce labor turnover, cut down absenteeism, reduce compensation payments and immeasurably improve employer-employee relationship, with consequent increase in production.

An adequate industrial health program should embrace the following:

1. Physical examination for proper placement.
2. Periodic examination of those employed in hazardous occupations, or who through actions or conduct such as lowered production, emotional disturbances or excessive absenteeism, show the need for such an examination.
3. Terminal examination to determine the physical condition of the individual when his employment is terminated.
4. Maintenance of medical records as confidential medical information.
5. Application of good medical and surgical procedures for those injured as a result of industrial employment and emergency treatment of non-occupational diseases.
6. Consultation and advisory service to which employees may come with any physical or emotional problems that they may be advised and referred when necessary to their own physician or the proper community service
7. Absenteeism—a scrutiny of all unusual absenteeism to determine and correct the cause which is frequently physical or mental.
8. Health education relative to the materials and conditions of their working environment; the proper use of protective measures against dust or fumes, vapors, and materials which are potentially dangerous to health; education in personal hygiene, nutrition, and the utilization of the various official and non-official agencies which can assist in the maintenance of health and well-being of our citizens; preventive disease measures as inoculations, mass X-rays to discover tuberculosis, information on cancer and venereal disease, heart disease, etc.
9. Adequate record system which can be utilized to determine the extent and cost of the service and what has been accomplished.

Does industry feel that adequate industrial medical service pays? Let me quote what the National Association of Manufacturers of the United States has to say in a survey of more than one thousand industries.

> *Labor Turnover and Absenteeism*
>
> Of one thousand and eight companies, more than 20 per cent had a reduction in absenteeism. Two hundred and thirty-four companies reported an average reduction of practically 30 per

cent. Nearly 90 per cent of eight hundred and twenty-four returns showed a reduction in labor turnover. One hundred and eight-six companies put their reduction at an average of 27.3 per cent.

Compensation Premiums

Ninety-three per cent of one thousand and sixty-seven companies report a reduction, and nearly one-half of them report reductions averaging 28.8 per cent.

Occupational Diseases

Of eight hundred and six companies, 92 per cent said that their medical service had reduced occupational diseases.

Advantages of Medical Service

Of one thousand six hundred and twenty-five answers to the question whether this type of service was worthwhile, only five companies failed to mention that they considered their health program "a paying proposition."

The encouraging note in this development is the realization on the part of industry, labor and the medical profession that this work must go forward. Industry is providing improved health programs for its workers and much interest has developed in the provision of adequate health programs for small industries. Labor is keenly alive to the benefits to be derived, and health problems have become an important part of labor-management relations. There has been a considerable increase in undergraduate and post-graduate instruction in industrial medicine: foundations and institutes of industrial hygiene and medicine have been established, and fellowships provided to train men for this work.

We, as health officers, should be alive to this awakened interest, and with the co-operation of industry, labor and the medical profession, through our industrial hygiene activities, put into practice those public health activities which cannot but have a marked effect on the prevention of disease and improvement of health of this important part of our population.

The Place of the Victorian Order in the Public Health Set-up of the Community

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THE Victorian Order of Nurses offers a variety of services in the 103 branches across Canada. I shall endeavour to give the whole Canadian picture showing the place that the Victorian Order occupies and the contribution it makes to public health. Visiting nursing is recognized by public health authorities as an essential part of a community health service. It is designed to assist families to meet the emergencies due to illness in their homes and to improve the general health through health instruction.

The V.O.N. aims to supplement but never to supplant the work of the official agency. When there is an official agency in the community, there is an understanding between the official agency and the V.O.N. as to the particular work each is to undertake. For example, in Brantford, Ontario, the city nurses report all prenatals to the V.O.N., which carries these cases during the prenatal and the post-natal periods, referring the mothers and babies at the end of the six-week period either to the private physician or to the well-baby clinic which is conducted by the city nurses. The health program is planned jointly and regular conferences are held between the city nurses and the V.O.N. so that there will be no overlapping, thus leaving time, energy and money for other fields of activity.

When there is not an official agency in the community, the V.O.N., although existing primarily to give visiting nursing service, is prepared to render the type of public health nursing service of which the community is in need. The V.O.N. works closely with the medical profession and observes professional ethics at all times. The types of service given by the V.O.N. include care to individuals in their homes and group work. The work in the home consists of bedside nursing and instructive visits; the group work includes clinics and classes, school nursing, and part-time industrial nursing.

Bedside nursing, given to anyone needing care in his own home on a visit basis, includes baths, hypodermic injections, dressings, minor operations, confinements, and care to mothers and babies—in fact, any nursing care that can be given in the home. Sometimes the bedside nursing is only incidental to the other service given in the home. To illustrate how we incorporate health teaching with bedside nursing, let us take the case of a diabetic. On the first visit, we would give the hypodermic injection and plan an outline for teaching the

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patient or a responsible member of the family how to give it. The number of lessons would depend, as in any teaching, on the ability of the pupil to learn. The teaching would include not only asepsis, accurate measurement and the actual giving of the hypo, but also such things as care of the skin, signs of over- or under-dosage, and a knowledge of the disease. Often the diet outlined has to be interpreted and help given in getting variety as well as balance in the meals. This would lead to a further study of a balanced diet for the whole family and perhaps help in budgeting. The patient is encouraged to lead as normal a life as possible and rehabilitation is planned, for improved mental health.

Or let us take the case of a child with rheumatic fever. In giving nursing care, we would, of course, follow our rule of working only under the doctor's supervision. We would bathe the patient and demonstrate to the family how to bathe and handle him. The health teaching would include rest and exercise—how much and how often; a suitable diet, including the essentials for balance, variety and colour; and care of the heart. The co-operation of the family is sought to maintain a calm, happy atmosphere. There should be an equalization of responsibility to give the mother a chance for recreation. This develops a sense of responsibility in the brothers and sisters and they would find pleasure in doing things for others. Quiet games could be played by the whole family. Planning them would develop initiative and perhaps reveal hidden talents. When visitors are allowed, playmates should be of the same age group. If possible, classroom instruction should be arranged for, so that when the child goes back to school, he will be in his same age group. The aim is to get him back to normalcy as soon as possible. Thus, you see, we treat the patient as a whole, physical, mental, spiritual and social. Through the individual, an opportunity to serve the entire family is gained. It may be that, in attempting to meet the health needs of the family, the nurse will note another factor quite outside the family but affecting it; for example, hygienic, economic or social conditions of community-wide significance.

The health-instruction program covers pre-natal and post-natal instruction, pre-school health supervision, and adult health education.

Pre-natal teaching is carried on in the home and in classes. In some cities we have pre-natal classes which are especially helpful for primiparas. It would be ideal to have a class for fathers so that they would feel that they are an essential part of the picture; they are anxious to be of help but often don't know how. This would also build up and strengthen the family unit. The pre-natal teaching prepares the mother's mind for the new experience of being a mother as well as a wife. She will get factual information about the development of the baby; and when the visits of the nurse are spaced between the mother's visits to the doctor's office, the patient will receive more evenly distributed supervision. We teach the patient the need for physical examination, rest, and exercise, and instruct her about diet, the prepartion of the layette, etc. If the patient is staying at home for the confinement, she will need instruction with regard to the preparations, including making and sterilizing supplies, and choosing

and preparing a suitable room. We try to approximate the hospital set-up. If there are other children in the family, it is an excellent opportunity for the parents to teach sex education. The children will learn how to adjust to a new member in the household and, if they are old enough, will learn how to care for the new baby, thus beginning to think in terms of their own adult life. Whilst giving nursing care during the post-partum period, the nurse has an excellent opportunity to give health teaching to the mother about the care of herself and her baby. We would discuss such topics as care of the breasts, the value of breast feeding, and the need for a balanced diet for a nursing mother—and, incidentally, a balanced diet for the whole family. We would include the advantages of supervision of the well baby and the prevention of illness by toxoids and serums, and would teach the mother the value of the post-partum examination.

In group work, we have clinics and classes, school nursing service, and part-time industrial nursing.

The child health clinic or conference is preventive in nature and is under different auspices in different cities. Where there is no other agency doing it, we carry on a complete immunization program. This may include protection against whooping cough, smallpox and scarlet fever, as well as diphtheria. The nurse organizes the clinic and assists the doctor. In some centres the nurse has a well-baby conference for weighing the baby and giving instruction to the mothers, but there is no doctor in attendance. In Sherbrooke we are planning to include dental service, both curative and regular follow-up work.

School Nursing. Everyone is familiar with school nursing. About a quarter of our branches supply school nursing to their districts. We hand this over to the official agency when it is prepared to take it.

Part-time Industrial Nursing. Part-time industrial nursing is one of the special activities which is considered to be the responsibility of a visiting nursing organization, both in Canada and the United States. Employers are recognizing more and more the value of having some provision for medical and nursing care for their employees. The service now includes so much more than the checking up of absenteeism and the giving of first-aid. Where there is a plant doctor, a pre-employment examination, including a blood test and chest X-ray, is given. The nurse assists the doctor with the examination. One of the most important assets of industrial nursing is the conference with the workers regarding their health problems, including arrangements for improved nutrition and, if possible, a hot lunch. Attention is given also to plant sanitation. The service is purchased on a part-time basis by small industrial plants where the number of employed personnel is not large enough to require a full-time nurse. The arrangement has worked out satisfactorily for these small plants as it insures the services of a nurse qualified to do public health nursing. She knows her community resources and her organization is prepared to give nursing care to the employees and other members of their family when it is needed. There is the added advantage that the nurse is a member of a supervised staff.

Teaching given by the V.O.N. is four-fold: (1) to the patient and his family, (2) staff education, (3) public health knowledge to student nurses, and (4) interpretation of our work to the community.

Teaching to the patient is given to improve his health and prevent further illness; to the family, to aid in giving care between the nurse's visits, thus hastening recovery. Staff education—the head nurse's responsibility—consists of introducing the work to the new nurse (that is, teaching on the job) and staff conferences which provide for the continuous growth and development of all the staff nurses. This results in better care and teaching to the patients. We believe that it is our responsibility also to impart the public health aspect of nursing education to the student nurses by lectures and an observation period, so that they will have a more complete knowledge of nursing and understand their patients better. Interpreting our work to the community is done by giving talks to groups such as service clubs and women's organizations. This insures that the people in the community will understand our service and receive benefit from what we have to offer. Publicity also insures continued financial support necessary for survival and growth.

There is room and a definite need in almost every community for Victorian Order service which co-operates with and supplements the work of official agencies or, if working alone in a community, prepares the way for the official agency when the service is inaugurated. The aim of all of us, whether employed by official or voluntary agencies, is to work towards the provision of the broad public health needs of the community without overlapping or gaps in the service, with our respective responsibilities defined as clearly as possible through mutually understood written agreements.

Symposium on Population

3. MORTALITY TRENDS AND PUBLIC HEALTH IN CANADA

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WHAT are the three most important trends in the field of population and vital statistics today? I think they are the following: (1) the decline of fertility and the birth rate, (2) the ageing of the population, and (3) the different rates of decline of age-specific death rates and of the death rates from various causes.

These three trends are clearly interdependent. The decline of mortality in the young and middle age groups increases the proportion of people who survive to old age. The decline of the birth rate cuts down the number of children and young people and thus also contributes to the ageing of the population. On the other hand, because mortality in the upper age groups has not declined, and because the population is getting older, the proportion of deaths from these causes which affect mainly older people will continue to increase. In the light of these three trends, the emphasis of public health will have to be re-directed.

This article will deal mainly with the third trend—the different rate of decline of age-specific death rates and of the death rates from various causes. The relationship between this trend and the ageing of the population will also be briefly discussed. Eventually public health will no doubt have to give some attention to the first trend, to the problem of maintaining a birth rate at least high enough to replenish the population from generation to generation. In a fundamental sense, a population which is dwindling in numbers cannot be considered healthy. A "nation without children" is one which lacks confidence in the values of its way of life and is unable to adapt itself adequately to changing conditions and the demands of social progress. But for the present, we shall leave this problem aside.

I

The difference in age-specific death rates is well known. The lowest rate is in the age group 10-14 years, where the annual probability of death is now slightly over 1 per 1,000. Mortality at birth is very high. During the first week of life it is about 175 times as high as during an average week of the second year. During the second year, in turn, it is about six times as high as the average in the age group 10-14 years.

At age 30, the probability of death is about 2.5 per 1,000. From that age on, it increases by about 10 per cent with each additional year of life. Thus, average mortality in the age groups above 70 is almost 100 times as high as in the age group 10-14 years, about 40 times as high as in the age group 20-29 years, and about 20 times as high as in the age group 40-49 years. At age

60 the probability of death is 18 per 1,000, at age 75 it is 75 per 1,000 and at age 90 it is 240 per 1,000. Such is the application of the law of compound interest to Canadian mortality.

The pattern of the different rates of decline of age-specific death rates is less well known. As a result of this pattern, the contrast between mortality at the ages at which it is highest and at which it is lowest is becoming greater.

Let us take, as a starting point, the death rate at age 1. In 1926-28 it was 1,604 per 100,000 population; in 1942-44 it was 585 per 100,000. Thus, the death rate at age 1 has declined nearly 65 per cent within the past twenty years. This decline is greater than that of any other age-specific rate.

Death rates at age 1 and above are shown in Table I. The comparative decline of the rates is illustrated in Chart 1. It will be seen that the lowest rate, for the age group 10-14 years, has declined about 50 per cent. As the age increases, and with it the death rate, the rate of decline becomes less.

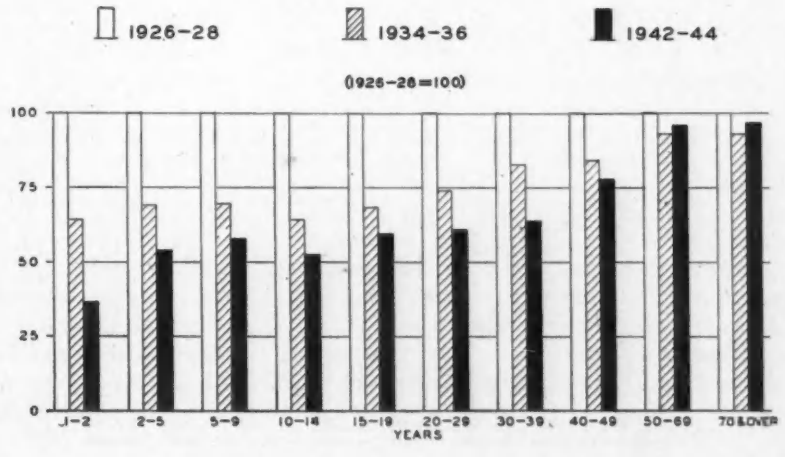
TABLE I

AGE-SPECIFIC DEATHS RATES, CANADA, 1926-28, 1934-36 AND 1942-44
(PER 100,000 POPULATION)

Age	1926-28	1934-36		1942-44	
	Rate	Rate	Per cent decline from 1926-28	Rate	Per cent decline from 1926-28
1	1603.7	1031.5	35.7	585.1	63.5
2 - 4	520.9	359.5	31.0	280.6	46.1
5 - 9	241.5	168.4	30.3	139.8	42.1
10 - 14.....	203.2	130.8	35.6	106.4	47.6
15 - 19.....	286.6	196.3	31.5	171.1	40.3
20 - 29.....	378.5	280.3	25.9	230.5	39.1
30 - 39.....	456.3	379.7	16.8	292.1	36.0
40 - 49.....	684.3	578.3	15.5	533.6	22.0
50 - 69.....	1866.5	1746.3	6.4	1803.5	3.4
70 + ...	9391.8	8769.7	6.6	9142.2	2.7

CHART I

COMPARATIVE DECLINE IN AGE-SPECIFIC MORTALITY RATES
CANADA 1926-28, 1934-36 AND 1942-44



For the rates above age 50, the decline has been very small and, in fact, over the past ten years, the rates have been going up.

Death rates at age 1 and below are shown in Table II. The comparative decline of the rates is illustrated in Chart 2. Here, the effect of age is the opposite to that shown in Table I. As the child advances through the first year of life, not only does the mortality rate become much smaller, but the proportional decline increases. We have seen that the rate for children in

TABLE II

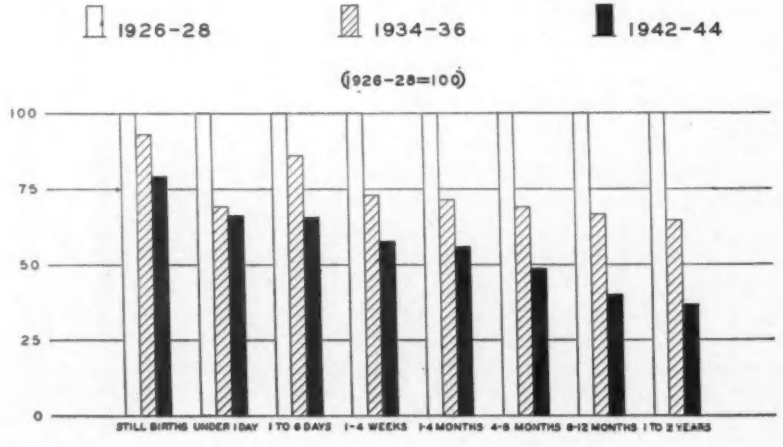
STILLBIRTH AND INFANT MORTALITY RATES AT EACH AGE, CANADA, 1926-28, 1934-36 AND 1942-44

(per 1,000 entering each age group)

Age	1926-28	1934-36		1942-44	
	Rate	Rate	Per cent decline from 1926-28	Rate	Per cent decline from 1926-28
Stillbirths (per 1,000 total births)	30.3	28.2	7.0	24.0	21.0
Infant Mortality—Under 1 Day (per 1,000 live births)	17.4	12.0	30.9	11.5	33.9
1 Day—1 Week (per 1,000 children 1 day of age)	15.2	13.0	13.9	9.9	34.6
1 Week—1 Month (per 1,000 children 1 week of age)	13.5	9.9	27.1	7.8	42.5
1 - 4 Months (per 1,000 children 1 month of age)	24.5	17.4	28.7	13.6	44.4
4 - 8 Months (per 1,000 children 4 months of age)	17.2	11.8	31.0	8.3	51.6
8 - 12 Months (per 1,000 children 8 months of age)	11.2	7.4	33.4	4.4	60.2
Mortality during Second Year of Life (per 1,000 children 12 months of age)	15.9	10.3	35.5	5.8	63.5

CHART 2

COMPARATIVE DECLINE IN STILLBIRTH AND INFANT MORTALITY RATES AT EACH AGE, CANADA 1926-28, 1934-36 AND 1942-44



their second year has declined nearly 65 per cent. By contrast, the rates for infants in their first week have declined 34 per cent. The shorter the period of life during the first and second years, the less the decline in mortality. The rate of stillbirths, where the period of life is zero, has declined only 21 per cent.

The result of the pattern illustrated in the two charts is to accentuate the contrast between mortality at the beginning and towards the end of life and mortality in the young and middle ages. On the one hand, mortality in the age groups from 1 to 49 years is becoming more nearly equal. On the other, the difference between the rates in these age groups and the rates in the first month and in the age groups 50 years and over is becoming greater.

When the birth rate is declining, efforts to reduce the rate of stillbirths and infant mortality become specially important. Estimates for the future show that, aside from immigration, we are passing from a rapidly increasing to a more or less stable and eventually declining population. When the population becomes older, the number of people exposed to the high mortality rates in the upper age groups increases. Over 65 per cent of deaths in Canada now occur at 50 years of age and over. The average age at death is now 53 years for males and 54 years for females. It will continue to go up.

II

Table III shows death rates from certain causes, the incidence of which is concentrated in the principal age groups.

TABLE III

DEATH RATES FROM CERTAIN CAUSES, CANADA, 1926-28, 1934-36 AND 1942-44

	1926-28	1934-36		1942-44	
	Rate	Rate	Per cent decline from 1926-28	Rate	Per cent decline from 1926-28
Premature Birth[1]	1998.6	1565.3	21.7	1169.0	41.5
Diarrhoea and Enteritis[1]	1771.5	953.5	46.2	634.6	64.2
Four Communicable Diseases[2]	27.7	15.6	43.8	8.7	68.6
Tuberculosis[2]	85.2	62.5	26.6	50.5	41.6
Cardio-Vascular-Renal[2]	350.5	332.2	5.2	393.4	+12.2
Cancer[2]	103.5	115.4	11.5	118.9	+14.9

[1]Infant mortality rate per 100,000 live births.
[2]Standardized death rate per 100,000 population, based on the population of 1943.

(A) Mortality due to premature birth is overwhelmingly concentrated among infants under 1 month of age; 95 per cent of deaths due to this cause are to infants under 1 month, and these constitute about 40 per cent of all deaths at this age. Mortality due to premature birth declined 42 per cent from 1926-28 to 1942-44. This is fairly well in line with the decline of the rates shown in Table II for the age under 1 month.

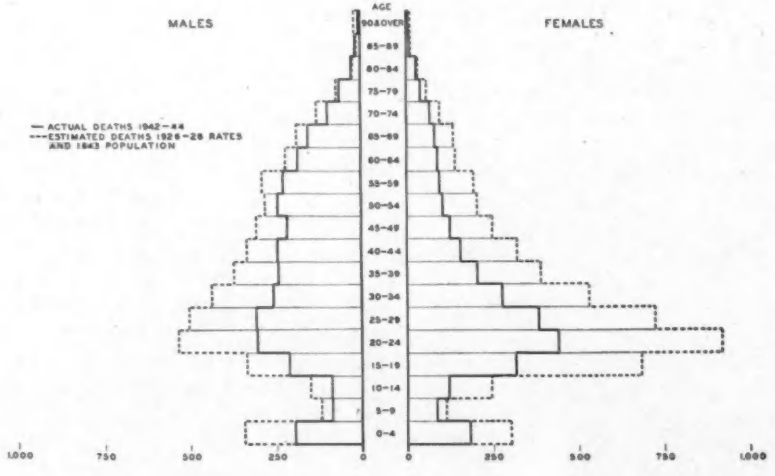
(B) In contrast to mortality due to premature birth, mortality due to diarrhoea and enteritis is concentrated among infants 1-12 months of age; about 65 per cent of all deaths due to this cause are to infants in these months. The rate of infant mortality due to diarrhoea and enteritis declined 64 per cent from 1926-28 to 1942-44; this is somewhat greater than the decline of the rates shown in Table II for the ages 1-12 months. Diarrhoea and enteritis now accounts for slightly over 20 per cent of all deaths in these months.

(C) The decline of mortality due to the four communicable diseases—scarlet fever, whooping cough, diphtheria and measles—is too well known to require much comment. Deaths due to these causes now constitute a very small proportion of all deaths, even in the age group 0-4 years, in which about 75 per cent of them occur. The standardized death rate per 100,000 population declined 69 per cent from 1926-28 to 1942-44; the rate of infant mortality due to these four diseases declined 59 per cent, and the rate for the age group 1-4 years declined 75 per cent. The above four communicable diseases are an outstanding example of a public health problem which to a large extent has been solved.

(D) Tuberculosis is one of the most important causes of death in the age groups 15-49 years. Among males, it is the second leading cause following accidental deaths; among females, it is the leading cause, and is especially heavy in the ages from 20 to 34 years. Chart 3 shows the sex and age distribution of deaths from tuberculosis. The dotted line shows the number of deaths which would have occurred at the rates of 1926-28 if applied to the population of 1943. The solid line shows the average actual number of deaths in 1942-44.

CHART 3

AGE DISTRIBUTION OF DEATHS FROM TUBERCULOSIS
CANADA 1926–28 AND 1942–44



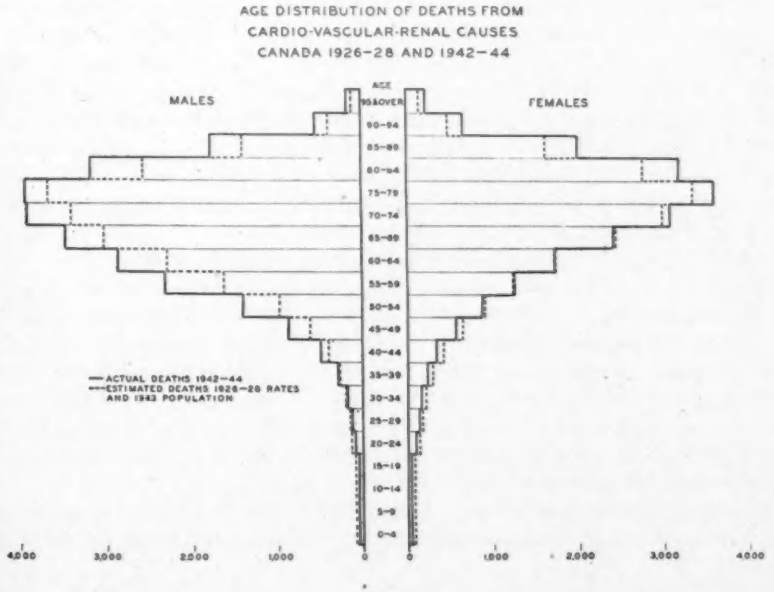
Of the deaths from tuberculosis, about 55 per cent among males and 70 per cent among females occur in the age groups 15-49 years, and these now account for about 20 per cent of all deaths in these age groups. The average age at death from tuberculosis in 1942-44 was 38.7 years for males and 32.1 years for females. Tuberculosis is thus a disease which affects primarily the young adult and working population.

It is evident from the chart that the death rate from tuberculosis has been greatly reduced. The decline has been greatest, both absolutely and relatively, in the age groups in which mortality was—and still is—heaviest. The standardized rate per 100,000 of the female population fell from 93.2 in 1926-28 to 48.7 in 1942-44, or by 48 per cent; the standardized rate per 100,000 of the male population fell from 77.4 to 52.2, or by 33 per cent. The average decline, as shown in Table III, has been 42 per cent.

Tuberculosis constitutes a public health problem which is on the way to solution, but in which there is still a long way to go. Methods of detecting and treating tuberculosis are now known, but they have not yet been everywhere applied in public health programs.

(E) Cardiovascular-renal conditions and cancer are the leading causes of death in the age groups 50 years and over. At the same time, deaths from these causes are concentrated in the upper age groups. Chart 4 illustrates the sex and age distribution of deaths from cardiovascular-renal causes. It is drawn in the same way as Chart 3.

CHART 4



Over 90 per cent of deaths due to cardiovascular-renal causes occur at 50 years of age and over, and more than 40 per cent at 75 years of age and over. The average age at death from these causes is 69 years among males and 71 years among females.

The figures for cancer are much the same. Eighty-five per cent of deaths from cancer occur at 50 years of age and over. The average age at death from cancer is 65 years among males and 63 years among females. Cardiovascular-renal causes account for 55 per cent of all deaths in the age groups 50 years and over, and cancer accounts for a further 16 per cent.

Thus, with the gradual ageing of the Canadian population, the trend of mortality due to these causes is especially important. This trend is at present rising. As shown in Table III, the standardized death rate per 100,000 population rose 12 per cent from 1926-28 to 1942-44 in the case of cardiovascular-renal causes and 15 per cent in the case of cancer. Part of the rise in the former rate may be due to changes in the classification of causes of death in 1941; from 1926-28 to 1934-36, in fact, the rate declined. A real increase seems to have taken place in the rate from cancer.

Cardiovascular-renal conditions and cancer constitute a public health problem which has not been solved, which on the contrary is increasing in importance. The ageing of the population increases the incidence and burden of these and other diseases and causes of death primarily associated with advanced age. The attention and effort of public health are therefore being turned more and more to these diseases.

III

The foregoing brief survey of the leading causes of death in the principal age groups leads to some general conclusions about the development of public health, to a possible explanation of the pattern of the decline of age specific death rates illustrated in Charts 1 and 2. Why is it that mortality in the young and middle age groups has declined most, while in the upper age groups it has hardly declined at all? There are, it seems to me, two main reasons.

In the first place, mortality in the young and middle ages of life is more "evident", it stands out more. To see people in old age die is one thing—it is perfectly natural and expected. At age 60 or 70 and over, death occurs at the end of a reasonably long and, in most cases, a useful and happy life. On the other hand, to see children and young people die is altogether different. The death of an infant in its first year robs the country of about 65 years of expected life, including 35-40 years of productive life. The death of a young man or woman involves a terrific waste of the investment which has been made in his or her upbringing and education. When people die at age 35 or 40, their productive life is only half over. And so on. A death at age 60 or 70 is not the same thing, from a medical, demographic or economic and social point of view, as a death in infancy, at age 30 or at age 40.

In the early period of rational medical science, when it was first developing (say 100 to 150 years ago), mortality among children and young people was

exorbitantly high—as it still is among the majority of the world's peoples. This high mortality naturally commanded and absorbed the attention of medical research and public health measures. Efforts were concentrated on reducing it first.

In the second place, the diseases mainly responsible for exorbitantly high mortality in the young and middle ages were infectious diseases. Having once determined their cause, it became possible to isolate cases of infection and to control their spread. Moreover, the incidence of infectious diseases varies greatly according to social conditions and the general standard of living. This is shown, for example, by the enormous differences in infant mortality and tuberculosis which still exist between social classes, between rich and poor. The rise in the general standard of living has helped, and will in other countries help, in the control and reduction of mortality from these diseases.

The leading causes of stillbirths, of infant mortality in the first month and of mortality in the upper age groups are not infectious. The variation of their incidence according to social conditions is also much less. They constitute public health problems of the future, problems which remain to be solved.

IV

In assessing progress thus far, and in allocating effort and resources for the future, it is nevertheless important to bear in mind, first, that there is still a long way to go before mortality in the young and middle age groups can be considered sufficiently low and that, moreover, it has to be *kept* low, which is no mean task. Second, that numbers of deaths alone can be a very misleading guide.

At present, there are in Canada approximately 6,500 stillbirths a year, and approximately 15,000 infants die during their first year of life. Some 6,000 people die from tuberculosis each year. On the other hand, taking the leading causes of death in the upper age groups, about 14,000 deaths a year are due to cancer and about 46,500 deaths are due to cardiovascular-renal conditions. Do these simple figures provide the correct basis of comparison? Do the corresponding rates per 100,000 population provide the correct basis of comparison?

I do not think so. The average age at which death occurs, as well as the number of deaths, is also of great importance. Expressed in another way, the normal life expectancy at the time of death must also be taken into account. According to the age at which death occurs, a greater or smaller number of expected life years is lost.

Applying this concept to the numbers of deaths given above, the following results are obtained:

> The life expectancy lost by stillbirths amounts to a yearly average of about 450,000 life years, that lost by infant mortality amounts to a yearly average of about 1,000,000 life years, making a total of nearly *1.5 million* life years lost by deaths in the first year.

The life expectancy lost by death from tuberculosis amounts to a yearly average of some 225,000 life years.

Though there are more than twice as many deaths a year from cancer as from tuberculosis, the life expectancy lost by death from cancer is less, namely, about 220,000 life years. This works out to an average of 16 life years per death from cancer, compared to an average of 38 life years per death from tuberculosis.

The life expectancy lost by death from cardiovascular-renal causes amounts to a yearly average of 550,000 life years. Though there are more than twice as many deaths from these causes as the total of stillbirths and infant deaths combined, the life expectancy lost is only about *one-third* as great.

Viewed in this light, the relative importance and severity of mortality from various causes is quite different from what the numbers of deaths alone would suggest. It is more than ever clear that mortality in infancy and in the young and middle age groups is still too high.

V

What will be the position in the future? Unless past trends change drastically, the Canadian population will be considerably older, the birth rate will be a great deal lower and the average expectation of life will be longer.

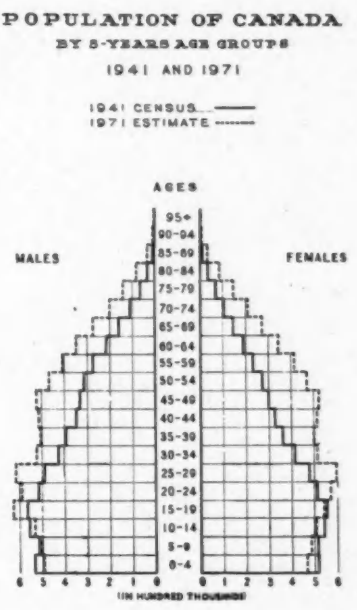
The age distribution of the population of Canada is illustrated in Chart 5. The solid line shows the actual population of 1941; the dotted line shows the estimated population of 1971, according to the figures presented in Bulletin F-4, "The Future Population of Canada," published by the Dominion Bureau of Statistics in the spring of 1946.

The proportion of the population in the young age groups 0-19 years is estimated to fall from 38 per cent in 1941 to 28 per cent in 1971. The proportion in the adult and working age groups 20-59 years is estimated to increase slightly from 51 per cent in 1941 to 57 per cent in 1971. The proportion in the age groups 60 years and over is estimated to increase greatly, from 10 per cent in 1941 to 15 per cent in 1971.

The fall in the proportion of children and young people in the population is, of course, due to the decline in the birth rate. During the war and post-war years, the birth rate in Canada has been high. By 1971, according to the estimates, it will have fallen by about 40 per cent, from 23.8 per 1,000 in 1944-45 to 13 or 14 per 1,000.

Mortality rates in the young and middle age groups are expected to continue to decline more rapidly than in the upper age groups. Combined with the effect of the ageing of the population, this will mean, on the one hand, that an increasing proportion of deaths will occur in the upper age groups and, on the other, that the death rate from those causes especially associated with advanced age is likely to increase. Thus, the death rate from cancer per 100,000 population may increase by some 25 per cent, and the death rate from cardiovascular-renal causes by some 35 per cent. As we have seen, the

CHART 5



age-specific mortality rates from these causes have in recent years been rising; however, the increases which have just been mentioned are based on the assumption that the age-specific rates will fall somewhat in the future, and result entirely from the ageing of the population.

At present, 66 per cent of all deaths are to people 50 years and over; the average age at death is 53 years and the average expectation of life at birth about 65 years. In 1971, it is estimated that 84 per cent of all deaths will be to people 50 years of age and over; the average age at death will be 66 years and the average expectation of life will probably be between 70 and 75 years. People will live longer.

What conclusions can be drawn from these figures?

First, for the upper age groups in particular. It is well known that as age increases, the average length of illness increases also. Illness in the upper age groups tends to be chronic rather than acute; the average number of "patient-days" of incapacity and hospitalization is much greater. Chronic illness constitutes a heavy burden on public health facilities and the country's economic resources generally. It also involves suffering and in many cases extreme pain to the patients—a major hazard to the peace and happiness of old age. The longer expectation of life and the ageing of the population

emphasize the importance of this problem. The need for and timeliness of efforts to lessen the burden and suffering thus become clear.

Second, for the span of life as a whole. If the population is going to live longer, it should also live more healthily. The health and welfare of the people, and not only the prevention of disease and death, should be the concern of public health. Medical statisticians especially will have to give up their morbid habit of "measuring" the "state of health of the people" by the number who die from year to year. This will require new statistical measurements, as yet undeveloped. The standard of living, and particularly of nutrition and housing, must be raised. In the words of the Constitution of the World Health Organization: "Health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity."

Summary

1. Mortality rates are declining most at the ages for which they are lowest, and least at the ages for which they are highest. Thus, the contrast between mortality in the young and middle ages on the one hand, and at birth and in the upper age groups on the other, is increasing.

2. Despite the great progress in medicine and public health reflected in the decline of mortality in the young and middle age groups, mortality in these age groups is still too high. This is made especially clear by the figures of life expectancy which is lost by death.

3. The population in Canada is growing older, the average age at death is rising. Consequently, the emphasis of public health must be re-directed (*a*) towards the diseases and causes of death which affect old people and (*b*) towards improving the health and welfare, rather than merely preventing disease and death, of the population as a whole.

This is the last of a series of papers constituting the Symposium on Population presented before the Vital Statistics Section at the thirty-fifth annual meeting of the Canadian Public Health Association, held in the Château Frontenac, May 19-22, 1947. Part I, "A Survey of Quebec City Families", by Jean C. Falardeau, was published in the November issue and Part II, "Population Problems in Public Health—at the Provincial Level", by J. D. B. Scott, in the January number.

ABSTRACTS OF PAPERS PRESENTED AT THE FIFTEENTH ANNUAL CHRISTMAS MEETING OF THE LABORATORY SECTION, CANADIAN PUBLIC HEALTH ASSOCIATION, ROYAL YORK HOTEL, TORONTO DECEMBER 15-16, 1947

Modifications of Dubos' Medium with Observations on Inhibition of Virulent Human Tubercle Bacillus on a Solid Medium by Streptomycin and Antibiotic Substances. GORDON SHAW, Department of Hygiene and Preventive Medicine, University of Toronto.

DUBOS' LIQUID MEDIUM, described in the American Review of Tuberculosis, Vol. LIV, No. 3, September 1946, has been used for the culturing of virulent human tubercle bacillus H37Rv. Observations were made concerning the type of growth, the time of initial and maximum growth, the growth when different dilutions of inoculum were used, and the surface tension of this medium. Also the effect of the following modifications was studied: use of a 2 oz. screw-cap bottle for the culturing of tubercle bacillus; addition of serum, Tween, agar or other solidifiers, carbohydrate, supernatant of cultures of H37Rv and H.T.B. No. 607, yeast extract, liver extract, Vegex and Ascolecithin; aeration and production of anaerobic state of the culture.

Based on the above preliminary experiments, Dubos' medium, modified to include 10 per cent dried normal human serum, 1 per cent agar and liquid culture of H37Rv, was used to pour plates. These plates were very satisfactory and were employed to demonstrate the inhibitory action of streptomycin on virulent human tubercle bacillus (H37Rv). In addition, cultures of Gram positive cocci, obtained from the air, were streaked down the centre of plates and zones of inhibition of growth of tubercle bacillus were noted. On the other hand, it has been observed that some of these saprophytes have the effect of increasing the amount of growth of the tubercle bacillus. Filtrates of cultures of fungi were applied to these plates and some of these showed areas of inhibition of growth of tubercle bacillus. Slides and photographs, to illustrate some of these observations, were included.

A Plate Assay for Subtilin. HILDA MACMORINE and GWENDOLYN SLINN, Connaught Medical Research Laboratories, University of Toronto.

TURBIDIMETRIC methods of assay have obvious drawbacks for large numbers of routine tests. An attempt was made to assay subtilin by the accepted cup-plate methods but no zones of inhibition were produced with high concentrations and a sensitive organism. On the assumption that the rate of diffusion of the antibiotic was too slow to prevent the multiplication of the rapidly growing organism, experiments were undertaken to achieve a more useful balance between these factors. Preliminary refrigeration, to allow diffusion of the subtilin, with subsequent incubation proved to be a practical method. This has been carried out in several ways, the most useful of which is refrigeration for 20-24 hours followed by either incubation at room temperature for a further 20 hours or incubation at 37°C. for 6 hours. If room temperature is chosen, the plates are read in the usual way. If the short-time incubation is preferable, the zones are developed by the addition of potassium ferricyanide and ferric sulphate by a modification of the technique of Dufrenoy and Pratt.

Throughout the work a medium of the same nutritive constituents as that described for the assay of penicillin (F.D.A. 1944) was used. The base layer contained 2 per cent agar and the seed layer 1 per cent. The test organism was *Staphylococcus aureus* (209P), although some tests were done with *Micrococcus conglomeratus*. All potencies were determined in terms of a sample of partially purified subtilin received from Dr. Salle, to which an arbitrary unitage was assigned.

The turbidimetric methods recommended by Lewis et al. using both *S. aureus* and *M. conglomeratus* were tentatively accepted as a basis for reference. Nine samples from three different stages in the process of purification were chosen for extensive comparison. These were assayed at least four times by each of the four methods. By a simple analysis of variance, using all the observations for each method, it was found that the experimental error (within-sample variation) was as follows: *S. aureus* turbidimetric, 10.7 per cent; plates incubated at room temperature, 10.9 per cent; plates developed chemically after 6 hours at 37°C., 13.9 per cent; *M. conglomeratus* turbidimetric, 18.8 per cent.

The Nature of the Inhibitive Reaction in the "Indirect" Complement-Fixation Test. CHRISTINE E. RICE, Dominion Department of Agriculture, Animal Diseases Research Institute, Hull, P.Q.

IN AN ATTEMPT to apply complement-fixation as a supplementary serologic method in the study of pullorum infection in turkeys, it was found that sera of these birds repeatedly injected with *Salmonella pullorum* even though of high agglutinative titre, were without significant complement-fixing activity with *S. pullorum* antigens. Sera of chickens, ducks and geese similarly inoculated also failed to develop appreciable complement-fixing properties. In spite of their lack of fixability with homologous antigens, these avian antisera, when mixed in suitable proportions with antipullorum rabbit sera of high complement-fixing titre, partially or completely inhibited fixation by the latter with *S. pullorum* antigen. Normal or heterologous avian serum had no such blocking effect. The inhibitive properties of the antipullorum avian sera varied in relation to their agglutinative titre and appeared to be associated with the antibody itself. On the basis of these observations a method of titrating these inhibitive activities in antipullorum avian serum was worked out. This technique has been termed for convenience the *indirect* complement-fixation test to distinguish it from the usual or *direct* complement-fixation methods.

In an attempt to understand the nature of the inhibitive reaction it was postulated that the avian antibody combines with pullorum antigen to form non-complement-fixing aggregates, thereby preventing its combination with the rabbit antibody to form complement-fixing complexes. Thus, the amount of antigen left free to combine with the rabbit antiserum, and the consequent degree of fixation, will depend upon the antibody content of the avian antiserum. This hypothesis, therefore, stresses the quantitative relationships of all three reagents, the two antisera and the antigen.

Since in these pullorum tests crude bacterial suspensions or extracts were used as antigens, it seemed probable that several antigen-antibody systems may have been involved. It appeared desirable, therefore, to use a simpler system for quantitative investigation of the inhibition phenomenon. Types 1 and 2 antipneumococcus horse sera were selected for the purpose. These horse antisera also fail to fix complement with homologous carbohydrate antigens and inhibit fixation of complement by mixtures of such antigens with antipneumococcus rabbit serum of the same type, provided the latter is not present in definite excess. With an excess of rabbit antiserum, the inhibitory effect of the horse antiserum may be masked. However, if antigen is in slight excess, fixation of complement may occur even though the amount of horse antibody is greater than that of the rabbit. The length of time an antiserum is allowed to react with antigen before the addition of the second serum also influences the final result. When the second antiserum is added in excess, it appears to reorient the surfaces of pre-formed antigen-antibody aggregates, but has no reversal effect upon any fixation of complement that has already occurred. Since the antibody nitrogen content of both the antipneumococcus horse and rabbit sera was known, it was possible to adjust the level of sensitivity of the *indirect* complement-fixation test so that the serum dilution titre of a horse serum obtained by the inhibition test was comparable to that of a rabbit serum of the same antibody nitrogen content determined by the *direct* complement-fixation test. As a result of these observations, specifications for the *indirect* complement-fixation test were more precisely defined.

The *indirect* and *direct* complement-fixation methods are now being applied in studies of certain viral infections in avian and mammalian species.

Relationship between Titres of Antipullorum Chicken and Turkey Sera Obtained by the "Indirect" Complement-fixation and Agglutination Method. CHRISTINE E. RICE and RONALD GWATKIN, Dominion Department of Agriculture, Animal Diseases Research Institute, Hull, P.Q.

ALTHOUGH ANTIPULLORUM CHICKEN and turkey sera do not fix complement with *Salmonella pullorum* antigens, they inhibit fixation by mixtures of antipullorum rabbit serum and the same antigen. The degree of inhibitory activity varies in relation to the agglutinative titre of the respective sera, a fact which has been utilized in the development of an *indirect* complement-fixation method of antibody assay. Titres obtained by this *indirect* complement-fixation method have been compared with those determined by the "whole blood" or "tube" agglutination techniques for 218 chicken and 151 turkey sera. These sera were serial bleedings from 99 chickens and 84 turkeys that either were survivors of a lot infected orally when one day old with *S. pullorum* or were in contact with such birds.

Of the 107 chicken sera negative in both agglutination tests, 84.1 per cent were also negative in the *indirect* complement-fixation tests and 17 or 15.9 per cent had relatively low titres (0.05 to 0.005 ml.). Eight of the 17 specimens were from birds whose sera had exhibited agglutinative activity earlier. Among 84 chicken sera positive in both agglutination tests, 97.6 per cent had definite inhibitory properties. Two specimens that showed agglutination in a 1:25 dilution only (whole blood readings 4 and 1 respectively) were negative in the *indirect* complement-fixation test. Some 16 of the remaining 27 chicken sera that were positive in one or other of the agglutination tests, but not in both, displayed inhibitive properties.

The majority of the turkey sera were collected at a stage when the agglutinative titres were falling rapidly or had already declined to a very low level. Of the 104 specimens that were negative in both agglutination tests 63.6 per cent were negative, 23.7 per cent had low and 10.6 per cent medium titres in the *indirect* complement-fixation test. Among the 35 reactive specimens were 24 from birds that had previously displayed agglutinative activity in their sera. Inhibitive properties were demonstrable in all of the specimens of turkey sera that were positive in both forms of agglutination test; 89.5 per cent had inhibitive titres of 0.005 ml. or higher. On the whole, therefore, the *indirect* complement-fixation method appeared somewhat more sensitive than agglutination in the titration of turkey sera.

These preliminary studies with sera of convalescent and contact chickens and turkeys have indicated a relatively good, general correlation between the results of the *indirect* complement-fixation and agglutination tests. Furthermore, in studies with a small number of non-pullorum chicken sera that had given "non-specific" agglutination of *S. pullorum* suspensions, negative results were recorded in the inhibitive test—evidence of the greater specificity of this method. In brief, therefore, it would appear that the *indirect* complement-fixation test may constitute a useful supplementary serologic method in investigations of pullorum infection and especially in connection with non-pullorum reactions.

Response to Oral Infection with Salmonella pullorum in Comparable Groups of Turkeys and Chickens. RONALD GWATKIN, Dominion Department of Agriculture, Animal Diseases Research Institute, Hull, P.Q.

ONE HUNDRED and fifty day-old poults and 308 chicks of the same age were infected by mouth with a variant turkey strain of *S. pullorum*. The mortality rate for the first 35 days was 64.6 per cent in the poults and 70.7 per cent in the chicks. *S. pullorum* was recovered from 89.6 and 95.4 per cent of these birds, respectively. Forty-nine poults and 47 chicks, which had been kept in pullorum-free quarters, were added to their respective groups at 36 days of age. In the next 10-week period, 10 principals and 8 contact turkeys were examined and *S. pullorum* was recovered from all of the former and 3 of the latter. Thirty-nine principals and 9 contact chickens were also examined, with recovery of *S. pullorum* from all of the former and 5 of the latter group. The maximum agglutinin production was 98 per cent of the turkeys and 87 per cent of the chickens. These antibodies declined rapidly in the turkeys. They showed only 30 per cent of partial reactions, 85 per cent of which were 1 plus or trace, on the 5th

test, whereas the chickens at that time showed 70 per cent of reactions, 59 per cent of which were complete in 1:50 and over. Comparison of whole blood and tube tests showed agreement of 85.7 per cent using 1:50 as the diagnostic tube dilution, and 84.3 per cent with the 1:25 dilution in turkeys; and 86.6 and 89.0 per cent for the same comparisons in the chickens. Apart from the question of agreement, the 1:25 dilution detected 12.5 per cent more of the total tube reactions in the turkeys and 6.5 per cent more in the chickens. The larger number of reactions in each group was shown by the whole blood test, the tube test being 0.8 per cent behind in the turkeys and 15.4 per cent in the chickens. Regular form antigen detected only 24.7 per cent of the reactions in both groups, and 72 per cent of the reactions with variant antigen were 4 plus as compared to 29 per cent 4 plus with regular antigen. The whole blood test with regular antigen detected from 2 to 5 times as many variant-produced reactions in chickens as tube antigen made from the same strain. This difference was not as marked in the turkeys. One loop gave better results than 2 loops of blood in the whole blood test as the latter amount inhibited agglutination. The homologous antigen was not as satisfactory for detecting agglutinins as antigen made from another variant strain, No. 296, and this was most noticeable in stained antigen for whole blood testing. The Connaught Medical Research Laboratories stained antigen, which contains regular and variant forms, detected all reactions which occurred with the straight variant antigen. In 25 per cent of the turkey reactions and 9 per cent of the chicken reactions the reading was 1 plus lower than the straight variant antigen, but the end results were the same with both. It is becoming evident that, while turkeys are as readily infected as chicks of the same age, and have as high a mortality rate in the acute stage, the majority of the survivors throw off the infection with a resultant disappearance of agglutinins, whereas a large proportion of the chickens remain as carriers of the infection. This may have an important bearing on the question of testing turkeys for pullorum disease.

A Twenty-Four Hour Medium for Isolation of Neisseria gonorrhoeae. C. W. CHRISTENSEN and H. W. SCHOENLEIN, Department of Bacteriology, Difco Laboratories, Detroit, Michigan.

THE PRIMARY PLATING procedure in the diagnosis of gonococcal infections by the culture method can be shortened from 48 to 24 hours. This may be accomplished by accelerating the growth rate of the gonococcus through the use of improved media.

An enriched chocolate agar medium* consisting of Proteose Peptone No. 3 Difco, 1.5 per cent; Corn Starch, 0.1 per cent; Sodium Chloride, 0.5 per cent; Dipotassium Phosphate, 0.4 per cent; Potassium Acid Phosphate, 0.1 per cent; Bacto-Agar, 1.0 per cent; Bacto-Hemoglobin, 1 per cent; and either Bacto-Supplement A or Bacto-Supplement B, 1.0 per cent, has been developed for the purpose of shortening the incubation period in gonococcal culture.

The complete medium is readily prepared by autoclave sterilizing double strength solutions of the agar base and Hemoglobin. Cool each to 50-60°C. and combine the sterile solutions. Add one per cent of either Bacto-Supplement A or Bacto-Supplement B to this liquid chocolate medium just before dispensing into sterile petri dishes.

This medium has consistently yielded as many or more positive isolations of *N. gonorrhoeae* after 24 hours' incubation as other media requiring a longer incubation period.

The various growth accessory factors, including Glutamine, Cocarboxylase, and Coenzyme, required by a certain number of exacting gonococcal strains are supplied by the supplements. Bacto-Supplement A differs from Bacto-Supplement B in that it contains Crystal Violet, which is helpful in suppressing growth of contaminating organisms.

**The improved basal medium known as Bacto-G C Medium Base, together with the Hemoglobin and supplements, are available from the Difco Laboratories, Detroit 1, Michigan.*

Penicillin Sensitivity of Gonococci. GORDON H. HAWKS and P. H. GREEY, Department of Pathology and Bacteriology, University of Toronto.

DURING THE PAST two years the penicillin sensitivities of 330 strains of gonococci were determined. Sixty-four of the strains were isolated and tested prior to the general distribution of

penicillin to the medical profession and served as a small control group. The remaining 266 strains were isolated and tested during the past year and a half, when penicillin has been used extensively in the treatment of gonorrhoea.

Most of the strains of gonococci studied were isolated from male patients attending the Special Treatment Clinic of the Toronto General Hospital. Some of the strains tested were grown from female patients attending the same clinic whilst others were kindly supplied by the Provincial Health Laboratory. The tests were conducted on solid media containing various concentrations of penicillin.

It was found that the *in vitro* penicillin sensitivity of gonococci isolated during the past two years was similar to that obtained with sixty-four strains isolated prior to the general distribution of the drug. The largest amount of penicillin required to completely inhibit growth was 0.06 units per cc. No strains resistant to penicillin were encountered. The findings indicate that penicillin therapy of gonorrhoea has not thus far been attended by any definite increase in the resistance of gonococci to the drug as evidenced by *in vitro* sensitivity tests.

A comparison of the rate of action of penicillin and of streptomycin on gonococci also was reported.

Antibiotics Active against Bacterial Viruses. IGOR N. ASHESHOV, FRIEDA STRELITZ and ELIZABETH HALL,* Department of Bacteriology and Immunology, Faculty of Medicine, University of Western Ontario, London, Ontario.

DIRECT tests with human and animal viruses in search for antibiotics against them are not yet suitable as a routine screening method. Bacterial viruses, i.e. bacteriophages as screening virus, answer the purpose well. If the antiphage substances discovered would not be active against other viruses, we still would have agents giving a new approach in the study of host-parasite relations and in the general study of cell biology.

Paper discs on agar plates and serial dilutions were used as assay methods. On plates flooded with bacteria-phage mixture paper discs soaked in active substance would be surrounded by a zone of normal bacterial growth, while the remaining parts of the plate would show confluent clearings of the phage.

An *Aspergillus* was found to produce two anti-phage substances:

(1) The anti-staphylophage substance. It is acidic in nature and can be extracted from the medium at acid reaction by organic solvents. It is stable between pH 2 and pH 10 and withstands heating to 100°C. The substance has been obtained in crystalline form but in amounts not yet sufficient for final purification and elucidation of its chemical nature.

Less than 1 part in 10,000,000 by weight will inhibit the development of staphylophage while staphylococci are affected only by much larger amounts, concentrations of 1:50,000—1:100,000 being required. The substance has no phagocidal action. It does not prevent the adsorption of phage on bacteria, but in its presence bacteriophage either does not multiply or is prevented from liberation from the bacteria. The action of antiphage does not seem to be influenced by the number of bacteria present but the more phage corpuscles are used the more antibiotic is required to suppress them. Different races of staphylophage show wide variations in sensitivity to the antiphage—from being completely arrested in their development to almost complete resistance. This difference is not influenced by the use of different strains of staphylococci. No phages besides staphylophages were found to be susceptible to this antibiotic.

(2) The other substance produced by the same mould is active against three streptophages out of twelve tried. It is basic and considerably less stable than anti-staphylophage substance. It also has no phagocidal action. The nature of its action on phage development is being studied and there seem to be many points of similarity of the action of the two substances in spite of their different chemical nature.

Experiments to try the action of the two antiphage substances on human and animal viruses are in preparation.

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*Aided by a grant from the Banting Research Foundation.

The Antibiotic Effect of Tomato Juice Extracts. J. W. CONNER and MARGARET M. HAUSER, Department of Bacteriology, Ontario Agricultural College, Guelph, Ontario.

DURING HOME CANNING experiments conducted at the Department of Horticulture, Ontario Agriculture College, comparing juice and brine covering solutions for low-acid vegetables, a reduction in numbers of surviving bacteria was noted when dilutions of tomato juice were used. The pH change being negligible, it was thought that perhaps the reduction was due to an antibacterial effect similar to *tomatin* isolated by Irving, Fontaine and Doolittle. The fact that certain plant extracts possess antibacterial properties has been known for some time.

Dehydrated tomato stems, leaves, seed, fruit and seedlings and commercially processed tomato juice and puree, were extracted with various solvents and the extracts tested for antibiotic properties against certain species of bacteria, yeasts and molds. Extracts prepared from tomato fruit, juice and puree with methyl hydrate, ethyl alcohol, and acetone with the pH adjusted to 4.70, 5.80 and 7.08 inhibited the growth *in vitro* of most of the aerobic and anaerobic bacteria tested but exhibited no effect on the molds and yeasts. The active principle has not yet been determined but further steps are being taken toward its purification.

Studies on an Antibiotic Substance Extracted from the Roots of Celastrus scandens. M. PANISSET and A. NANTEL, Institute of Microbiology and Hygiene, University of Montreal.

FROM THE ROOTS of *Celastrus scandens* treated with acetone, we have obtained an antibacterial principle, which we have tried to isolate.

The procedures were as follows:

(1) By acidification of the acetonic extract to pH 3, we have obtained a precipitate totally soluble in acetone and retaining entirely the antibacterial activity;

(2) By chromatographic absorption on alumina of this partially purified fraction (experiments in progress).

Preliminary assays seem to show that the active substance is not a protein, but probably a complex sugar.

The activity of the acetonic extract is especially high against Gram positive bacteria, notably against *B. tuberculosis* (avian type), and low against Gram negative bacteria.

Phage Typing in the Investigation of an Outbreak of Food Poisoning of Staphylococcus Etiology. E. L. BARTON, G. E. A. EDGE, and R. P. HARDMAN, Department of Health of Ontario.

TWO OUTBREAKS of food poisoning, involving over two hundred persons, are reported. Bacteriological examination indicated that these outbreaks were caused by contamination of food with haemolytic strains of *Staphylococcus aureus*. The use of bacteriophage in typing of the strains of *Staphylococcus aureus* isolated from food and lesions present on food handlers, showed common strains of these organisms, from several items of food on the menu, and also three of the food handlers. Epidemiological investigation indicated that one of the three food handlers was probably the initial source of the outbreak.

The Immunizing Efficiency of Diphtheria Toxoid when Combined with Various Antigens. L. GREENBERG and D. S. FLEMING, Department of Bacteriology and Immunology, McGill University, Montreal, P.Q.

A SERIES of experiments carried out in guinea pigs have demonstrated that mixtures of various antigens with diphtheria toxoid are more effective in stimulating the production of diphtheria antitoxin on single inoculation than is diphtheria toxoid alone in the same concentration. The animals were Schick-tested as a measure of diphtheria antitoxin response.

Mixtures of antigen tested in this manner were diphtheria toxoid and tetanus toxoid; tetanus toxoid and pertussis vaccine; diphtheria toxoid and T.A.B. vaccine; and diphtheria toxoid, scarlet fever toxin and pertussis vaccine.

In all cases there was an enhancement of the immunizing efficiency of the diphtheria toxoid as compared with a control group receiving diphtheria toxoid alone. This was at least doubled by the addition of pertussis vaccine, and increased five- to ten-fold when a third antigenic component was added.

Laboratory Studies of Combined Antigens. G. G. WATERS and D. R. E. MACLEOD, Connaught Medical Research Laboratories, University of Toronto.

LABORATORY EXPERIMENTS indicate that—(1) The antigenic response to diphtheria toxoid in guinea pigs as measured by survival after a challenge dose of diphtheria toxin is increased when given in combination with pertussis vaccine. (2) The antigenic response to tetanus toxoid in mice as measured by survival after a challenge dose of tetanus toxin is increased when given in combination with (a) T.A.B. vaccine, (b) pertussis vaccine, (c) diphtheria toxoid and pertussis vaccine.

Studies on Arrangement and Movement in Bacterial Swarms. R. G. E. MURRAY and R. H. ELDER, Department of Bacteriology and Immunology, The University of Western Ontario, London.

THE GROSS APPEARANCE of swarming of the *Kurthia* and *Proteus* genera on solid media is very different from that of certain members of the genus *Bacillus*. Although previous workers have demonstrated the general form of swarming units in these groups, there is a need for co-ordination of results and for detailed observation to demonstrate the basic similarity of all forms of swarming. The fact that out of a very large number of species of motile bacteria only a few possess the power of active swarming indicates that this is a phenomenon of considerable interest. The species of swarming organisms studied were: *Kurthia zenkeri, Kurthia zopfii, Proteus* spp., *Bacillus circulans, B. alvei,* and B. *sphaericus* var. *rotans.*

Direct observation under the microscope indicates that in all these species swarming is an active migration by organized groups of bacilli. In these species one type of moving group is common to all, and is what has been called a "bullet" or "comet" shaped colony. The size and morphology of this moving unit varies from species to species but consists essentially of a group of organisms arranged with their long axis in the direction of movement. These moving groups have a remarkable coherence and stability which is greatest among the species of *Bacillus*. The movement is smooth and without streaming within the colony. "Bullet" colonies form the only elements migrating into untravelled areas in the genera *Kurthia* and *Proteus,* and form the majority of migrating elements for *B. alvei* and *B. sphaericus* var. *rotans.*

In certain species another moving unit is observed as a circular colony which rotates and moves in a direction. This is the predominant type of colony with *B. circulans.* The organisms are arranged tangentially in these colonies which rotate as a plate on the surface of the medium. Such colonies are seen in the other species of *Bacillus* but most are stationary (although they rotate) and many are formed by "bullet" colonies moving in a tight curve and becoming rotating colonies. This is true also with *Proteus* and *Kurthia,* where rotating elements may be seen and are directly due to a migrating mass taking an extreme curved path.

These two types of moving colonies leave characteristic trails by dropping single organisms or very small groups which immediately lose their motion and do not regain it until they undergo further growth. With *Kurthia* and *Proteus* the trails are the framework for travel of filaments and groups from the parent mass. This leads to a "honeycomb" appearance behind the advancing margin. A similar appearance is gained with other species on wetter agar. In all species studied the moving units tend to be produced in crops; a migratory phase followed by a period of consolidation, followed again by a migratory phase. This is familiar as the "tree-ring" appearance of *Proteus* swarms and is present, but less evident, with the other swarming species.

Among all these swarming species there is the same basic pattern with modification only in detail, which would indicate some basic biological cause for co-ordinated behaviour. The factors that determine such stable aggregation and polarity for a group of theoretically free-living cells must be of most fundamental importance.

A cinephotomicrograph film has been made and shown at the meeting to demonstrate the microscopical appearance of colonies and the characteristics of their movement in the phenomenon of swarming.

Observations on the Effect of Atabrine (chloromethoxy-(methyldiethylamino) butylamino-acridine) upon Growth. A. A. KINGSCOTE, Ontario Veterinary College, Guelph.

THE CONTINUAL administraiton of atabrine at the rate of 0.1 grams to each Imperial gallon of drinking water, during a period of one hundred and five days, failed to prevent growing turkey poults from becoming infested with *Histomonas meleagridis.*

The indication are that the atabrine, by the seventy-seventh day of the experiment, had caused a marked reduction of growth which amounted to a difference of approximately one pound in weight between the experimental and control birds.

A Quantitative Method for the Assay of Serum Neutralizing Antibodies against Eastern Equine Encephalomyelitis Virus Using the Chick Embryo. J. CRAWLEY, Connaught Medical Research Laboratories, University of Toronto.

EMPLOYING THE PROBIT method of statistical analysis, a method accurate within ± 60 per cent has been developed for the quantitative evaluation of serum neutralizing antibodies against equine encephalomyelitis virus. The degree of neutralization of the virus in a given mixture was not increased by incubation at 37°C. but if the virus-serum mixtures were kept at 4°C. a much lower degree of neutralization was apparent. The greatest activity of an immune serum was evident when the virus-serum mixtures were inoculated by the yolk-sac method using 15-day embryos. In contrast to this, the least neutralization was apparent if the virus-serum mixtures were inoculated in the allantoic sac of 15-day eggs. Younger eggs inoculated by either route revealed intermediate degrees of neutralization of the virus. This test has been successfully used to follow the development of neutralizing antibodies in the blood of horses inoculated with sub-lethal doses of living virus. The maximum level of neutralizing antibodies was reached about 40 days after inoculation. All detectable neutralizing antibodies had disappeared by 160 days.

Rapid Laboratory Diagnosis of Smallpox. C. E. VAN ROOYEN, Connaught Medical Research Laboratories, University of Toronto.

VARIOLA MAJOR can be diagnosed on the third day of illness when the rash first appears. The test consists of the examination of lesions for the presence of Paschen elementary bodies. The finding of these is of diagnostic value, and a positive result is obtained in a high proportion of cases.

The Mazzini Microscopic Flocculation Test for Syphilis used as a Screen Test. R. H. ALLEN and M. A. MASON, Laboratory of Hygiene, Department of National Health and Welfare, Ottawa.

MANY LABORATORIES have adopted the practice of performing a preliminary rapid, supersensitive test in the serodiagnosis of syphilis, a step which has become necessary with the increasing number of specimens submitted for examination. The use of a simply conducted, relatively sensitive diagnostic test as a screening procedure is attractive, and favourable results with the Mazzini microscopic flocculation test have been reported. In the present study the Mazzini test has been carried out along with the Kahn presumptive test and a complement fixation test (Kolmer regular simplified) on specimens obtained from a presumably healthy group of individuals. The procedures recommended by Mazzini have been followed strictly but all degrees of reaction have been noted, including ± or "rough" readings (interpreted as negative

when the test is used in a diagnostic capacity). With the Kahn presumptive test, 1+ and ± reactions have been noted, which is a common practice when this procedure is used as a screen test. A total of 8,871 specimens have been examined with the three tests, of which 236 (2.7 per cent) showed some degree of reaction with the Mazzini test and 54 (22.9 per cent) of these were confirmed with the Kolmer complement fixation test. Confirmation with the Kolmer test was obtained on 57 (9.0 per cent) of the 636 specimens reacting to the Kahn presumptive test. The Mazzini test was negative and the Kolmer positive or doubtful on 20 specimens (0.23 per cent of the total number examined). Negative results with the Kahn presumptive test on specimens positive or doubtful to the Kolmer test were obtained on 17 specimens (0.19 per cent). It is concluded that the use of the Mazzini microscopic flocculation test as a screening procedure merits favourable consideration.

Variations in Viruses and in Their Hosts. J. W. FISHER, Laboratory of Hygiene, Department of National Health and Welfare, Ottawa.

VARIATION in the resistance of animals to viruses is illustrated by examples. Under certain conditions, for example with poliomyelitis, vaccine, herpes simplex and Western equine encephalomyelitis viruses, the logarithms of the individual effective doses are normally distributed. This makes possible the application of the quantal type of assay (Bliss) for evaluating the infectivity of such viruses either alone or in the presence of immune sera. In many instances, however, the practicality of such a procedure is precluded by the low slope of the linear dosage-response curve.

The *interference effect* and *variation* encountered in strains of herpes simplex and Western encephalomyelitis viruses as well as the importance of such phenomena in so far as they pertain to methods of virus assay are discussed. On the hypothesis that the inocula were not "homogeneous", by certain laboratory methods variants of these viruses were selected which produced different qualitative and quantitative responses in the test animals.

Some Observations on the Determination of Haemoglobin. E. M. SHAVER, Department of Public Health Nutrition, School of Hygiene, University of Toronto.

OF THE SEVERAL sources of error in the commonly accepted procedures for haemoglobin determination, at least two could be eliminated.

Results are frequently expressed in terms of percentages of a standard which is as yet undefined, and which varies with the make of instrument used. It is urged that all readings be expressed in absolute values as grams of haemoglobin per 100 ml. blood, thus placing results from various laboratories on a comparable basis.

There could be made available a simple and reliable method of standardizing any type of haemoglobinometer commonly used in this country. This could be carried out by the use of haemin as an absolute standard for the purpose of periodic checks on the accuracy of the instrument, and could be supplied in standardized form including instructions for its quick and easy use by the busy physician and technician.

Several investigators have reported significant diurnal variations in haemoglobin values. Wilkins (1946) has described fluctuations of considerable magnitude between morning and afternoon values in Florida school children. On the basis of his results, the time element in haemoglobin determinations would be an important consideration, especially in individuals who are borderline to "anaemic" levels. In a recent study here on 50 school children and 37 adults, the mean variation between morning and afternoon values was 0.5 grams per 100 ml. blood, with a range of variation from −1.2 to + 2.9 grams per cent: a range which is of less magnitude than that described by Wilkins. While values obtained here are of statistical significance, it is not felt that the extent of the variation is sufficiently great to warrant special consideration in the determination of haemoglobin.

Etiology of Sarcoidosis. M. C. DINBERG, Division of Laboratories, Department of Health of Ontario.

THE ETIOLOGY of sarcoidosis of Boeck has been ascribed variously to an unknown agent, to a reaction to the lipoid fraction of many organisms, and to the tubercle bacillus. The disease is primarily chronic, capable of involving many organs and producing characteristic pathological lesions, sometimes regressing spontaneously, sometimes terminating in tuberculosis. The case presented is sarcoidosis of the knee, with the recovery of tubercle bacilli from the synovial fluid of that knee. No clinical or radiological evidence of tuberculosis could be found in other parts of the body and the tuberculin test was negative.

A Method of Typing Haemophilus influenzae by the Precipitin Reaction. C. F. C. MACPHERSON, Department of Bacteriology and Immunology, McGill University, Montreal.

PATHOGENIC STRAINS of *Haemophilus influenzae*, in contrast to non-pathogenic forms, produce an irridescent growth on Levinthal or Fildes agar and have a well-defined capsule composed of type-specific polysaccharide.

In the course of immunochemical studies on *H. influenzae* it was noted that extracts of non-encapsulated, non-irridescent derivatives of type b meningeal strains contained type b carbohydrate.

The ease with which capsules of pathogenic *H. influenzae* degenerate under laboratory conditions subsequent to isolation from clinical material is well known. Thus, it was considered that a method by which minute amounts of capsular substance could be isolated and identified by the precipitin reaction would be useful as an adjunct to the capsular swelling technique in identifying a poorly encapsulated strain and as well to ascertain the origin of derivative strains in which the transition from S→R was not complete.

The method devised depends upon dissolving the bacterial culture in 90 per cent phenol followed by alcoholic precipitation of the bacterial proteins and specific polysacharide. The carbohydrate is extracted from the precipitate with saline and the saline extract added to samples of the six type-specific antisera. A positive test is indicated only by a marked turbidity which develops within five minutes after mixing the reagents.

Cross Agglutination between Salmonella pullorum and Paracolon Types Isolated from Fowl. W. H. BURTON, Department of Bacteriology, Ontario Agricultural College, Guelph.

EXPERIMENTAL WORK has been carried out to attempt to explain the increasing numbers of non-pullorum reactions in the routine agglutination test for pullorum disease and also to determine the significance of such reactions.

Work by Kauffmann, Edwards and Bruner, and Wright has shown that the antigenic factor XII is subject to form variation and consists of three parts, XII_1, XII_2, and XII_3. XII_1 is apparently constant but the amounts of XII_2 and XII_3 vary. The standard strain of *S. pullorum* contains strong XII_3 and weak XII_2 while the variant strain contains strong XII_2 and weak XII_3. An antigen made from one strain will not detect all infections caused by the other strain. In order to detect both types of infection, two antigens are used in the tube test and a mixed antigen in the whole blood test. This has reduced the number of true pullorum reactions but the number of non-pullorum reactions has increased, especially with the variant antigen.

A flock of 90 birds which had given non-pullorum reactions was obtained, kept some time for observation and then sacrificed for post-mortem examination. Cultures were also made from these birds. Sixty per cent of all hens showed abnormalities of some kind, consisting of necrotic spots on the liver and spleen, tumours in the body cavity and oviduct, and darkened and misshapen ovules. Thirteen point seven per cent of the hens had completely inactive ovaries.

The organisms isolated were divided into three main groups: (1) Gram positive cocci, (2) coliform group, (3) miscellaneous group consisting of proteus, alcaligenes and unidentified genera. An enterococcus was isolated which gave a strong reaction with variant pullorum serum. Non-reacting hens inoculated with this organism developed strong cross reactions with variant antigen. Absorbing the XII_2 factor from these sera with *S. reading* eliminated the cross-reactions.

One representative culture of each of the following organisms was inoculated into negative hens and pullets:

Paracolobactrum coliforme
" aerogenoides
" intermedium
Colobactrum coli
" aerogenes
Salmonella reading

The hens gave poor response, but all the pullets gave strong cross-reactions with variant antigen, except those inoculated with *Colobactrum coli* which gave no reaction, and *Paracolobactrum intermedium* which reacted with the standard antigen. Cross-reactions went as high as 1/640. Absorbing XII_2 from the sera which reacted with variant antigen eliminated the cross-reaction, and absorbing XII_3 from the *Paracolobactrum intermedium* sera achieved the same result. The *S. reading* strain gave cross-reactions with both variant and standard antigen.

Apparently some non-pullorum reactions are the result of invasion by organisms which have antigenic factors similar to *S. pullorum*. The XII_2 factor seems to occur most frequently. Why bacteria which are normal inhabitants of the intestine should invade various organs has not been determined.

Salmonella Typing in Ontario and the Use of Polyvalent Antisera. V. CROSSLEY, M. FERGUSON, P. IRVINE and M. HASTINGS, Division of Laboratories, Department of Health of Ontario.

SALMONELLA TYPING by the Kauffmann-White Schema has been carried out at the Laboratories of the Ontario Department of Health since 1935. In that time 27 different types have been identified. Of these, *Salmonella tennessee, anatum, reading* and *bonariensis* were of animal origin. *Salmonella enteritidis, montevideo, choleraesuis, typhimurium, paratyphi B* and *oranienburg* were identified from both man and animals. The remaining 17 types were of human origin.

In 1945 polyvalent Salmonella sera were prepared by a modification of Kauffmann's method (1942). All cultures suspected of belonging to the Salmonella group are screened through these polyvalent seras. This permits an early, preliminary report of Salmonella isolations, which is followed later by a final identification when an antigenic analysis has been completed.

The Specificity of the Bursting Factor of Cl. perfringens. V. FREDETTE, A. FRAPPIER and R. JODOIN, Institute of Microbiology and Hygiene, University of Montreal.

IT WAS DEEMED of interest to know whether the bursting factor reported by us in 1946 is to be found in different strains of *Cl. perfringens* as well as in strains of other bacteria.

For this purpose, strains of *Cl. perfringens* were obtained from several sources and were grown in Vf broth for 8-12 hours at 37°C., after which they were filtered on fritted glass (Pyrex UF).

After testing the filtrates for sterility, toxicity determinations were made by intravenous injections of the filtrates into mice.

Finally, the bursting action of the filtrates was determined by injecting 1 cc. of filtrate with 1,000,000 washed cells of the homologous perfringens bacilli.

Results show that all strains of *Cl. perfringens* tested will produce the specific factor in Vf broth. Moreover, strains of *Cl. perfringens* which give off no toxin can give the bursting factor as well as those strains which produce toxin.

It is apparent from these same results that the filtrate from one given strain of *Cl. perfringens* will operate with the washed bacilli of any other strain of *Cl. perfringens.*

Since filtrates of either *Cl. septicum or B. coli* did not activate washed cells of *Cl. perfringens,* it may be assumed safely that the bursting factor of *Cl. perfringens* is specific inasmuch as it will operate only with washed cells of the species.

A Report on a Survey of Non-injectable Penicillin Preparations. A. RUTH THOMAS and M. E. CAMPBELL, Laboratory of Hygiene, Department of National Health and Welfare, Ottawa.

THREE YEARS' EXPERIENCE in the control of injectable penicillin has shown that continued checking on the potency of the marketed product is necessary. With penicillin more plentiful and more widely distributed, there has been an increasing demand for its incorporation into ointments, buffered tablets and other easily administered preparations. In many cases these newer products were prepared by smaller pharmaceutical establishments. From the manufacturer's point of view, in addition to routine potency determinations, there was the problem of selecting a satisfactory base in which the penicillin remained stable.

Since very few of these preparations are received directly from the manufacturer, it seemed desirable to conduct a survey on those preparations already on the drug market. Accordingly inspectors of the Food and Drug Division were instructed to obtain samples of any non-injectable penicillin preparations on the Canadian market. During March and April 1947 the following penicillin samples were submitted to the Laboratory of Hygiene for examination: ointments, throat lozenges, chewing troches, buffered tablets for oral use, hypodermic tablets, dental cones and aqueous solutions. Penicillin was assayed by the standard cup plate method using *S. aureus.* Crystalline sodium penicillin G was used as a reference standard.

Of 342 samples received, 102 or 30 per cent were below 80 per cent of claimed potency; of these 102 low-potency products, 45 or practically one-half were below 60 per cent of declared potency. Although in many cases the information given on labels was not complete, it was clearly indicated that regulations governing storage conditions and date of expiration were needed. A brief sketch of the proposed new regulations is presented.

Some Observations on the Preparation of Rabies Vaccine Using Phenol. T. C. CAMPBELL and R. D. DEFRIES, Connaught Medical Research Laboratories, University of Toronto.

THE INTRODUCTION of the mouse test by Webster in 1939 made possible the determination of the antigenicity of rabies vaccines. As a result, vaccines of greater antigenic value have been prepared. A modification of the method of preparing rabies vaccine employing phenol (Semple method) is described in which phenol, 1 per cent, is added to a 30 per cent suspension of rabid brain tissue, in place of an 8 per cent suspension as usually employed in the preparation of rabies vaccine by the Semple method. The antigenic value of the vaccines so prepared has exceeded the minimum standard as recently established by the National Institute of Health, Washington, namely protection against 1,000 M.L.D. of challenge virus. A change, also, in the strain of virus in the preparation of both human and veterinary vaccines may be a contributing factor to their improved antigenicity. Vaccines for veterinary use prepared from rabid calf brain tissue possess a much greater antigenic value than vaccines made from rabbit brain tissue. Observations over a period of years of veterinary vaccines prepared from calf brain and processed by this method indicate that their potency is retained for a much longer period than that of vaccines prepared by the standard Semple method for human use. The destructive action of freezing on rabies vaccines containing phenol is known. Further supporting evidence of this fact is supplied.

Ringworm of the Scalp in Ottawa Public Schools, 1946-47. L. P. MACHAFFIE, School Medical Officer, Ottawa Public Schools; S. F. PENNY, Director, Provincial Regional Laboratory, Ottawa; and E. C. BECK, Bacteriologist, Provincial Regional Laboratory, Ottawa.

AN OUTBREAK of ringworm of the scalp occurred among the public school children of Ottawa between November 1946 and December 1947. A clinical and laboratory investigation of this outbreak is reported. The Woods lamp which causes infected hairs to show characteristic fluorescence was employed in routine examinations. By this means early cases with no clinical signs were detected and control measures effected. It also made possible the selection of more satisfactory specimens for laboratory examination. In the laboratory, a total of eight-four specimens from children were examined. Only four specimens of hair from girls were examined, one being positive. All others were from boys. Sixty-seven specimens were examined both microscopically and culturally, and of these 37 or 55 per cent showed *Microsporon audouini* by both tests. Fifiteen of the 67 or 22 per cent were negative by both tests. Nine of the 67 or 13 per cent were negative by the microscope and positive by culture. Six of the 67 or 9 per cent were positive by the microscope and negative by culture. Unlike other reported outbreaks of ringworm, *M. audouini* was the only fungus from the infected hairs and skin scraping. Treatment and control measures are discussed.

Canadian Journal of Public Health

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SURVEY OF PUBLIC HEALTH PRACTICES IN CANADA

FEW will argue the fact that there is a serious shortage of trained public health personnel in Canada. The reasons advanced to explain this shortage are many but, generally speaking, little has been done by organized public health in this country to solve the problem. Basic information is lacking. For some time the Executive Committee of the Canadian Public Health Association have been aware of the need for an objective study of the work of the public health physician and nurse. During the fall, the objectives of such a study were discussed with the W. K. Kellogg Foundation, and in January the Foundation expressed its interest in the plans by providing financial support. The project is now under way.

A Study Committee on Public Health Practices, responsible to the Executive Committee, has been chosen, and two sub-committees, nursing and medical, have been appointed to carry out the work of their respective groups. While these sub-committees are drawn, in the main, from Association members within easy reach of Toronto, corresponding members are being selected from other agencies interested in the study. Provincial committees will be set up to act as consultants to the committee. The Association has been fortunate in obtaining the services of Miss Lyle Creelman, B.A.Sc.(Ng.), M.A., of the Metropolitan Health Committee of Vancouver, to act as field director for the public health nursing sub-committee. Dr. J. H. Baillie, D.P.H., will act in a similar capacity for the sub-committee on public health physicians.

The Study Committee consists of Dr. J. S. Kitching, Assistant Medical Officer of Health, Hamilton, chairman; Miss Isobel Black, Assistant Superintendent, Victorian Order of Nurses, Ottawa; Miss Helen Carpenter, Supervisor of Public Health Nursing, East York—Leaside Health Unit, Ontario; Miss Helen McArthur, Director of Nursing Services, Canadian Red Cross Society, Toronto; Dr. James Mather, Director, Halton County Health Unit, Ontario; Dr. William Mosley, Director, East York—Leaside Health Unit, Ontario; Dr. D. W. S. Puffer, Assistant to the Chief Medical Officer of Health for Ontario; and, ex-officio, Miss Creelman and Dr. Baillie. Dr. Mosley is chairman of the public health physicians sub-committee and Miss McArthur chairman of the public health nursing sub-committee.

The committee have outlined the following initial plans:

The study and follow-up will extend over a period of three years. The objectives are to study the work of the medical health officer and the public health nurse in order to produce and implement plans for retaining and using more effectively the trained public health personnel who are available. In addition, as a result of such studies, modification of the present programs, redistribution of duties, or the addition of other types of workers to public health personnel may be made.

The purpose of the proposed study, then, is to gather the facts relating to the actual work of physicians and public health nurses in local health departments, urban and rural. The frequently made statement that many duties are being assumed by these members which could be transferred to others or not included in the field of their activity will be reviewed in the light of the findings of the study. The next step will be to implement training programs and promotional recruitment work that the study may reveal as necessary.

The Study Committee intend to obtain the factual information from field studies of sample areas across Canada. Advice will be sought from health authorities in all provinces and from those agencies or institutions which the committee feel are concerned with the problems under study.

This is the most extensive piece of work undertaken by the Association. It is hoped that it will merit the full co-operation of those in the public health field in Canada.

ONTARIO HEALTH OFFICERS ASSOCIATION

CANADIAN INSTITUTE OF SANITARY INSPECTORS

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ANNUAL MEETINGS

ROYAL CONNAUGHT HOTEL
HAMILTON

April 26 and 27, 1948

ABSTRACTS

The Epidemiology of Poliomyelitis

PROFESSOR STEWART'S paper impresses one as being a very thoughtful, scientific and commonsense examination of the major features of the poliomyelitis problem. How our knowledge of the subject has advanced in the past few years is strikingly demonstrated. Attention is also directed to the gaps in our knowledge and the failure so far to develop worthwhile control measures.

Laboratory studies of human sera for neutralizing antibodies and the demonstration of virus in pharyngeal washings, in tonsil tissue, and in stools have served to clarify the epidemiological picture. The presence of neutralizing antibodies at birth in most infants, their absence in the majority at 1 to 2 years of age, and presence in 75 to 80 per cent of young adults presents a pattern which can only be accounted for by widespread subclinical or silent infection. Clinical poliomyelitis can be responsible for only a fraction of this adult immunity.

Virus isolation bears out the above interpretation. Not only is the virus found in the fæces and oro-pharyngeal washings in approximately 70 and 40 per cent respectively of human cases but it is found also in the stools and pharyngeal secretions of healthy persons who have been in contact with paralytic poliomyelitis and remained well.

Such studies indicate that only about 1 per cent of those infected develop paralytic disease and a further 2 to 8 per cent non-paralytic illness. This justifies the author's view that "poliomyelitis is for the most part a submerged epidemic which is below the level of clinical recognition but which may be just as extensive as measles". The jig-saw pieces of scattered clinical cases, the periodicity of epidemics, and the usual finding of only one clinical case in a family all fall into place on this basis.

The relative importance of the virus in the oro-pharynx and the intestinal tract in relation to dissemination is less readily settled. Virus in the former is present apparently for only the first two or three days of the disease, whereas in stools it has been found in a higher proportion of cases and for much longer periods. In one case, virus was isolated on the 123rd day. Such findings would serve to explain the occasional winter case but do not rule out the possibility that oral dissemination is the more significant in relation to epidemic spread.

Isolation of virus from sewage, sewage-contamined water sources, and from flies is also noted and tabulated summaries are presented of the evidence for and against the various modes of spread and portals of entry. No final answer is, however, available and in the meantime both oral and fæcal sources should be regarded as potentially dangerous.

Possible reasons for the invasion of the central nervous system by the virus, with resultant paralysis in about 1 per cent of those infected, are examined, with particular emphasis on tonsillectomy. The evidence at present suggests that there is a higher incidence of poliomyelitis in tonsillectomized children and definitely shows that bulbar involvement and consequent mortality is more common. It is reasonably suggested, therefore, that tonsils should not be removed during the poliomyelitis season unless their presence is an immediate and serious hazard to health.

Other factors which have been put forward as possibly related to central nervous system-invasion are exposed dental pulp (no evidence), intestinal trauma and illness, chilling or exposure, hormonal influences, and recent or unusual stress. Study of this last factor, clinically and experimentally, indicates the wisdom of limitation of activity for any child with a minor illness or a known exposure to a case.

Control of this disease is still in the future. A specific preventive is lacking but research in viruses generally leaves room for hope. With high infectivity and low pathogenicity, isolation of the source and prevention of spread of the virus are methods of low efficiency and yet should not be abandoned for known cases and contacts. Similarly, methods of environmental sanitation, chlorination of water, pasteurization of milk, sew-

age disposal, fly control, swimming pool sanitation, while important if only part of the spread is by fæcal contamination, have been disappointing. Sanitation of the air by ultra-violet irradiation or aerosols is of unknown value where poliomyelitis virus is concerned.

Finally, the author draws a comparison between this disease and diphtheria, whooping cough, and measles and points out that deaths are many times greater for any of the latter and that if paralysis is included as well the relative importance of poliomyelitis is still less than that of the others.

C. B. Stewart, M.D., M.P.H. Nova Scotia Med. Bull., 1948, *27*:1.

BOOKS

Nursing in Modern Society. *By Mary Ella Chayer, R.N., A.M. New York: G. P. Putnam's Sons, 1947. 288 pages. $4.00.*

NURSING IN MODERN SOCIETY introduces a series of volumes named *Modern Nursing* which will deal with "major fields of nursing which are so well unified that instead of emphasizing the separateness of nursing, it will make clear the unity of nursing."

This book represents a very logical introduction to the series, for "it presents an enveloping concept of the true place of nursing today in the social background of which it is a part."

The content is well organized into three main sections: Part I, The Impact of Social Forces upon Nursing; Part II, The Influence of Social Forces upon Community Health Needs; and Part III, Building a Better Future.

The text is one that should prove of interest to a variety of readers. For the use of teachers, supervisors, and students, thought-provoking questions for discussion, as well as additional sources for wider reading, are listed at the end of each chapter and a bibliography given. For public health nurses the volume "makes plain the expanded concept of public health too, and shows the relation nursing bears to the objective of improved health status for this nation and for the world." It is to be hoped that the book will be read and be of help to lay groups employing nurses or interpreting nursing trends to the public.

Nurses who are studying the nursing trends which have developed to meet health needs of today are very apt to feel overwhelmed. *Nursing in Modern Society* presents these complex problems in a clear perspective and offers a breadth and freshness of vision which should provide insight for planning future activities. *Jean S. Clark*

Fatigue and Impairment in Man. *By S. Howard Bartley, Ph.D., and Eloise Chute, M.A. New York: McGraw-Hill Book Co., Inc., 1947. 429 pages. $5.50.*

SUBJECTS which lie in the borderland between physiology and psychology characteristically display a complex inter-relation of subjective and objective phenomena. Professor A. C. Ivy, in a foreword to this book, justly commends the unique clarity of treatment.

The authors interpret fatigue as an expression of the organism as a whole. It is the single phenomenon created by a multitude of related phenomena in the various parts of the animal's body. Impairment, on the other hand, is defined as the condition of tissue which may be discovered directly by physiological and biochemical procedures. Thus, the study of fatigue involves both subjective and objective observation while that of impairment may be entirely objective. This is essentially the differentiation between the psychological and physiological methods of investigation and this cleavage is recognized throughout the book.

The light thrown on both these phenomena by electrophysiological, metabolic, and nutritional studies is cited and discussed at length in chapters devoted to each of these branches of investigation. Other relevant biochemical and pharmacological investigations are mentioned and the broad gaps in present knowledge noted. The relations of various periodic biological phenomena (including sleep), of aging and of hours and conditions

of work (with special reference to industry) to fatigue and impairment are considered and favourable and unfavourable psychological factors discussed. The authors have special experience in the evaluation of visual performance. A detailed and critical review of the conventional type of "vision-fatigue" study is of special value due to the authors' experience in this work.

All the conclusions are well summarized. The wealth of psychological data on fatigue and the relative scarcity of physiological information on impairment is apparent. The authors succeeded in keeping the treatment on a purely scientific basis. Even in their conclusions they do not derive any over-simplified laws governing these processes nor do they cite any easy measures for their control. They do, however, achieve a remarkable degree of order in a hitherto chaotic field. This is done with full recognition of the incredible complexity essential to processes which simultaneously involve the majority of the structures and the functions of the body as do fatigue and impairment.

D. Y. Solandt

The Canada Year Book, 1947. *Authorized by the Hon. James A. MacKinnon, M.P., Minister of Trade and Commerce, and published by the Dominion Bureau of Statistics. Ottawa: The King's Printer, 1948. $2.00 (cloth bound).*

THE 1947 edition of the Canada Year Book, issued recently by the Dominion Bureau of Statistics, covers the present situation in the Dominion from coast to coast. The thirty-three chapter titles indicate the scope of the volume: psysiography, history and chronology, constitution and government, population, immigration and emigration, vital statistics, public health and related institutions, welfare services, crime and delinquency, education and research, production, agriculture, forestry, fur resources and fur production, fisheries, mines and minerals, power generation and utilization, manufactures, construction, labour, transportation and communication, domestic trade, foreign trade, prices, national accounts and public finance, currency and banking, insurance, post-war reconstruction, national defence, veterans affairs, etc., etc. In addition, there are special articles on Canadian citizenship, UNESCO, welfare and family allowances, crime and juvenile delinquency, national agricultural program and policy, Canadian Wheat Board operations, the Food and Agriculture Organization, irrigation in Western Canada, control of forest insect pests, and the geology of Canada. In the present volume the chapters have been rearranged and related subjects brought together so that the treatment is more logical and permits of more convenient cross-reference. The regular statistical and textual data of each chapter have been carefully revised, and a "Directory of Sources of Official Information" substituted for the detailed lists of publications given in previous editions.

Teachers, university students, and ministers of religion may obtain paper-bound copies at $1.00 each by applying to the Dominion Statistician, Dominion Bureau of Statistics, Ottawa. Orders for the regular cloth-bound edition should be addressed to The King's Printer, and not the Bureau.